

# Radio Fun

BULK RATE  
U.S. POSTAGE  
PAID  
PERMIT #1  
MANCHESTER, NH

\$2.00

"The beginner's guide  
to the exciting world  
of amateur radio."

## in this issue

### features

- 3 Packet Scene
- UK—1992 G3LDI
- 6 Refrigerant Pipe J-Pole NGØX
- 8 Hawaiian Hams Respond to Iki Devastation AH6KY
- 11 Alarm Foil Antennas WB2NEL
- 12 A Portable 40 Meter Helical Dipole KE8TQ
- 24 Kitt Peak Radio Observatory AJØN/LA6US

### kit review

- 20 Ramsey AA-7 All-Band Active Antenna N1GPH

### vintage review

- 30 The Yaesu FT-102 WB8JLG

### departments

- 26 Activities Calendar Staff
- 17 Ad Index Staff
- 16 Antennas, Etc. K4IPV
- 19 Computers in the Shack N1EWO
- 28 Flea Market Staff
- 5 Letters Staff
- 28 New Products Staff
- 14 Radio Magic WB8VGE
- 15 The Tech Side KB1IUM
- 29 Uncle Wayne's Bookshelf Staff
- 22 Upgrade ...
- Don't Stop Now WB6NOA
- 18 What's Next? WB2MGP

## Hams Aid in the Wake of Killer Tornadoes

Ham radio operators from throughout the South have rallied forces to aid victims of a series of devastating tornadoes that ripped through Mississippi, Tennessee and Alabama on Saturday night, November 21, 1992, and Sunday morning, November 22nd. At least 16 people were killed, with countless others injured and homeless.

All but one of the fatalities occurred in Mississippi Saturday night. At least six died when a tornado hit a trailer park in Brandon. The other reported death occurred in Toone, Tennessee.

The storm knocked out power to many homes in Rankin County, Mississippi, near Jackson. Also disrupted were many normal lines of com-

munications, including telephone and cellular telephone service. At least one 2 meter repeater was damaged and knocked off the air, but most others survived unscathed and were pressed into immediate relief operations service.

With the traditional communications services taken out, hams accompanied rescue workers who used doors from ripped-apart trailers as makeshift stretchers to move away the injured, according to a civil defense official.

In western Alabama, Danny Buford KC4RLR spent the following day in Ethelville, which was also hit by a severe twister. Buford used his amateur radio gear to help assess damage for the Red Cross. According to

KC4RLR, he saw at least three homes that were destroyed and many house trailers damaged beyond repair. Buford said that it was all but a miracle that nobody was killed in Ethelville, where seven people were hospitalized.

Amateurs involved in "Skywarn" severe weather spotting nets stayed on the job overnight. They were reported to have seen a tornado touch down about 11 p.m. and reported it and other critical storm information to authorities via 2 meter FM. The National Weather Service confirmed the sightings on Sunday the 22nd, noting that this help may have kept the death toll from growing higher. *Westlink Report's* Youth Editor Sam Garrett AAØCR and 1992 *Westlink*

*Report Young Ham of the Year* Angie Fischer KBØHXY were written up in the St. Louis, Missouri, newspapers for their participation in Skywarn operations.

Earlier Saturday, tornadoes caused serious damage and several injuries in parts of southeastern Texas. Skywarn hams also reported that a tornado touched down in southern Iowa as well, causing several minor injuries. And in Ohio, members of the Dayton Amateur Radio Association took the DARA Emergency van to a suburb of that city after a twister touched down causing minor damage on Monday November 23rd. *TNX KB4KCH, N8FPF, NØDN and others; Westlink Report, Number 639, December 10, 1992.*

## Operation: Holidays II: Amateur Radio and Seasons Greetings

by Lorraine S. Matthew

N4ZCF/AAM3PR

"Happy Holidays" . . . "Seasons Greetings" . . . "Love to all" . . .

During the holiday season, millions of people the world over look forward to celebrating this joyous time of year. Millions of messages of greeting and good will are sent to friends, acquaintances, and loved ones everywhere. Does your community know that mail and telephone are not the only modes available for sending messages? In this high-tech world, you, the amateur radio operator, can offer your friends and neighbors the opportunity to send radiograms.

*Operation: Holidays II* is a public relations campaign which promotes the use of radiograms by the general

public. Both the National Traffic System (NTS) and MARS (Military Affiliate Radio System) are available for the sending of messages. Much of the public doesn't know that either service exists. This is where you, the amateur, can help. You are the key to helping amateur radio by educating the public. The public needs to know that both the NTS and MARS are up and running and have proved their capability of carrying messages to and from loved ones. The ultimate goal of this program is to develop such familiarity by the public with the two traffic systems that the sending of radiograms becomes a natural, ingrained habit for people everywhere.

*Operation: Holidays II* was launched last October. Messages and bulletins

were being circulated via the 2 meter packet system to radio clubs and amateurs all over the country. Similar information was being circulated throughout the MARS system as well. The proposal urged all amateurs and MARS members to promote the idea of having the public send radiograms (civilian to civilian) via NTS and MARS (military to civilian or civilian to military) via MARS. The close cooperation between the two systems guaranteed smooth delivery, no matter what the entry point might be.

Amateurs radio clubs have an opportunity with this program to be of great service to their respective communities. Clubs usually have several traffic handling operators representing both systems. If this is not the case

with your club, find out who, in your community, does handle message traffic. Your club has the capability and the obligation to inform the public about the availability of the free and reliable services offered by amateur radio. Your club has the capability of connecting the public to the appropriate operators for service.

MARS and NTS have earned reputations for being top-notch services. Only by continuing to handle message traffic can these reputations be sustained. As you know, message handling skills are essential to the emergency capabilities of both groups. Only an informed public can generate the message traffic needed to keep traffic

Continued on page 27

## Gold Digger's Mountain Shack



Here is a photo of Stephen B. Barnett KD6CNU of San Carlos, California, and his mountain shack. He spent about three months last summer in the high Sierras of California, dredging for gold. He found some gold, but says that he never finds enough.

His ICOM W2-A is plugged into a cigar lighter in the Bronco, and the RF Concepts' dual-band power amp is jumpered to the truck's battery. All of this is then fed into an MFJ J-pole.

Stephen had several good contacts but also found several repeaters that never seemed to be monitored. He was able to get into a repeater owned by the Berryessa Radio Club and, thanks to that club, was able to talk with ham friends in the San Francisco East Bay

area. The distance from his location to the repeater was about 120 miles, and from the repeater to his friends' location about 30 miles. Not bad for only about 1.5 watts! He used the power amp only a few times, when there was some electrical interference such as thunderstorms.

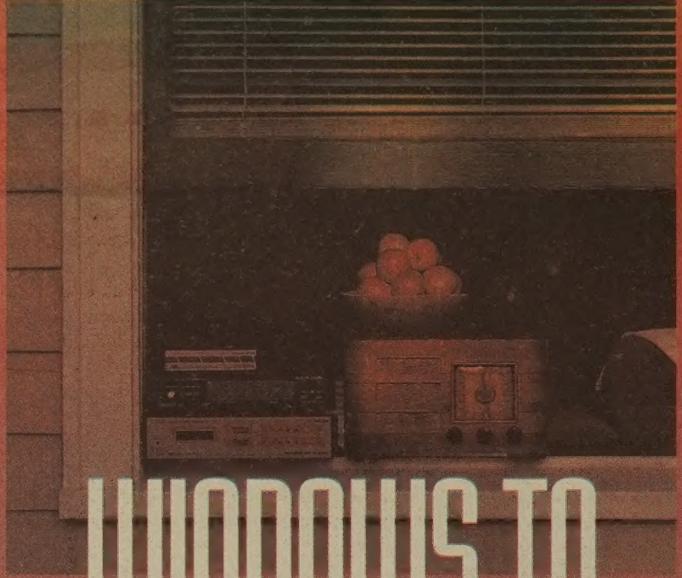
The weather was in the 90-to-100 degree range in the daytime and 40 to 70 at night. There were storms about every night, thunderstorms about twice a month.

Once a month his wife would mail him the monthly bills and magazines. He says that *Radio Fun* and 73 were VERY welcome in the evening around the Coleman lantern. They kept him abreast of what was going on in the real world.

## Ban on Cellular Scanners Signed

President George Bush has signed into law legislation that blocks the sale of radio equipment used to eavesdrop on cellular telephone calls. It directs the FCC to withhold its equipment authorization for any radio scanner that can receive cellular frequencies or that can easily be modified to receive such frequencies. The equipment cannot be sold without FCC authorization.

In about a year the law will also make it illegal to manufacture this type of equipment in the United States or import any such equipment made elsewhere. *TNX N7EP; Westlink Report, Number 639, December 10, 1992.*



## WINDOWS TO THE WORLD.

Pakratt for Windows is the only data controller program for Microsoft® Windows™ on the market today. AEA gives you a true Windows application for controlling AEA's entire family of data controllers, including the new DSP-2232 and the new PK-900. This graphics-oriented program offers all standard Windows 3.x features (cut-and-paste, custom window sizing and color selection, etc.) and can run minimized or in the background if desired. Also, PC-Pakratt's multi-tasking allows you to run two data controllers simultaneously. Other features include complete parameter screens, binary and ASCII file transfers, macros, QSO logging, comprehensive help and much more.

Get a whole new outlook on ham radio  
with PC-Pakratt for Windows from AEA.

Connect with us for your nearest AEA dealer or for a  
PC-Pakratt for Windows fact sheet.  
Call our literature request line at (800) 432-8873.

Advanced Electronic  
Applications, Inc.

PO Box C2160/2006 - 196th St. SW, Lynnwood, WA 98036  
Sales: (206) 774-5554



*Connect with us*

# Packet Scene UK—1992

by Roger J. Cooke, A.L.C.M., G3LDI @ GB7LDI

## Brief History

"Packet Radio" was an unknown phrase in the UK in the mid-1980s. An article in an American magazine captured the imagination of a few UK amateurs, myself included. This, together with a description of the TNC-1 and an offer of a kit of parts, started the ball rolling. Three other local amateurs were interested: Reg G8QR, Dave G4RSP and Donny G3PMQ (now, sadly, a Silent Key). We had to import the complete kit, minus the case, for around £250. That was roughly twice what a TNC would cost to buy off the shelf now, so it was no cheap outlay. However, the units are still working, three still on the original "breadboard."

We had lots of teething problems, not the least of which was dealing with a completely new mode. The experiments we conducted on 2 meters were met with various comments, and as a result we were put in a position to be able to help others. We all found that controlling the TNC parameters was the most difficult to learn. However, that mastered, several of us ventured onto the HF bands, where we found a few packet stations on 14.103. It seems strange now to think back to 1985. I would be out on business, in my car with 2 meter FM mobile, and would receive a call from a very excited G8QR: "Hurry back home, there is a packet station on 14.103."

After spending some time trying to work different countries I came across Jack Colsen W3TMZ, who was running a completely different kind of station—a BBS. Jack and I became very good friends and in early 1986 he brought me a Xerox 820. I obtained a pair of 8" disk drives and started running a BBS myself on HF and VHF.

I had to buy another TNC, the Pac-Comm 200, for HF. The real-time gateway facility was a novel feature which could be used, in those days, with little other traffic around. In fact, at one stage John A4XZL, who was stationed in the RAF out in Oman, connected to my BBS on 21 MHz, digipeated down to Cambridge, 60 miles to my south, and chatted to a friend of his. I doubt if that would be possible or even advisable now!

The packet explosion had begun. We began to find other small groups around the country in about the same state of development. In order to contact them and pass mail around, repeaters were set up and other amateurs began to run BBSs. Strangely enough, I was still the only one running an HF packet BBS. Even to this day there are only about three other HF gateways operational in the UK. However, that seems to be quite enough, as I can handle most of the traffic that comes through both ports. It is estimated that about one in three UK amateurs is now active on packet radio. We are not quite so fortunate as USA amateurs: Our VHF/UHF bands are just about half the size so we are restricted to a very small number of channels in comparison.

## Present Rules, Regulations and Permitted Frequencies

There are three categories of permitted operation: Attended Operation, Unattended Operation, and Mailbox Operation.

**Attended Operation:** The UK amateur license permits attended operation on all bands. This includes the operation of cross-frequency/cross-band nodes. Any port that is not cleared for unattended operation—either gen-

erally, under the terms of the license, or formally site-cleared by the Radiocommunications Agency (RA) of the DTI (Department of Trade and Industry)—must be turned off when the station is unattended.

Attended operation is defined as operation where the licensed operator is in control of the station and the equipment can be switched off IMMEDIATELY on receiving a request to do so.

**Unattended Operation:** The UK Amateur License permits operation on an unattended basis (excluding mailbox operation) on the following bands:

50	—	51	MHz
144	—	146	MHz
1299	—	1300	MHz
2310	—	2450	MHz
3400	—	3475	MHz
5650	—	5680	MHz
5755	—	5765	MHz
5820	—	5855	MHz
10000	—	10250	MHz
10270	—	10300	MHz
10400	—	10500	MHz
24000	—	24050	MHz

The following frequencies are the packet bandplan at present:

50 MHz	DX Packet Cluster access channel
50.61 MHz	Network access
50.63 MHz	Mailbox user access
50.65 MHz	DX and simplex operation
50.67 MHz	Network use
50.69 MHz	Specific application, e.g. TCP/IP
50.71 MHz	Not used. Guard channel for 9.6K baud
50.73 MHz	9.6K baud use
50.75 MHz	Network use
70 MHz	25 kHz channel
70.3125 MHz	150 kHz channel
1240.150 MHz	150 kHz network channel
1240.300 MHz	150 kHz network channel
1240.450 MHz	150 kHz network channel
1240.600 MHz	150 kHz network channel
1240.750 MHz	150 kHz network channel
1299.000 MHz	25 kHz channel
1299.425 MHz	150 kHz channel
1299.575 MHz	150 kHz channel
1299.725 MHz	150 kHz channel

70.3250 MHz	DX packet cluster access channel
70.3375 MHz	Mailbox and network access, user channel
70.4875 MHz	Network use
144 MHz	Simplex working or TCP/IP use
144.625 MHz	Network and mailbox, plus user access
144.650 MHz	Simplex working
144.675 MHz	Network use
432 MHz	Network use
430.625 MHz	Network use
430.675 MHz	Network use
430.750 MHz	Network use
432.625 MHz	Reserved
432.650 MHz	9.6K baud mailbox and user access
432.675 MHz	Mailbox and user access
433.625 MHz	DX packet cluster user access
433.650 MHz	Network use
433.675 MHz	Simplex working
433.725 MHz	Duplex channel
439.425 MHz	Network use
439.575 MHz	Simplex or duplex with above duplex channel
439.725 MHz	Simplex or duplex with above duplex channel
439.825 MHz	Simplex or duplex with above duplex channel
1.3 GHz	150 kHz network channel
1240.150 MHz	150 kHz network channel
1240.300 MHz	150 kHz network channel
1240.450 MHz	150 kHz network channel
1240.600 MHz	150 kHz network channel
1240.750 MHz	150 kHz network channel
1299.000 MHz	25 kHz channel
1299.425 MHz	150 kHz channel
1299.575 MHz	150 kHz channel
1299.725 MHz	150 kHz channel

As you can see from the above list, our 2 meter limitations severely curtail the networking capabilities of that band. Overcrowding has obvi-

ously added to the problem, with most users obtaining only 2 meter equipment. However, with the release of several channels on the 70cm band it is hoped that we can spread the load somewhat from both the user's and the network's point of view. Also, there are several high-speed (9.6K baud) links on the 23cm band, mostly used for forwarding/networking. Some groups are now experimenting with 56/64K baud, and there is one dedicated link already working at 56K baud. This will expand as equipment/funds allow.

Setting up high-speed links is a very expensive exercise when the modem, TNC, antenna and transceiver are all added together. As an amateur network, I think that we do quite a reasonable job. A suitable site has to be found, and paid for; the equipment has to be maintained, electricity provided and antennas mounted. To cover these sorts of expenses, various groups have formed all over the UK, each with several members paying their annual fees. The Norfolk AX25 Group is no exception and we have about 30 members locally. To help subsidize our expenses we have an annual barbecue which is run at a small profit but essentially to provide a family day out. This sort of event is quite well supported and always takes place on the last Sunday in June.

The sidebar shows the number of BBSs active at the present time. The full hierarchical addressing should be used if sending mail to the UK. If you are sending mail to the UK and are not sure of the full address, just refer to a map and send it to the nearest BBS on the list. Even if you do not get it right first time, White Pages will find him from there. However, to send mail into the UK blind with an address which consists of only the recipient's call-sign, is like aiming for the waste bin!

## Forwarding Scene

My forwarding BBS, GB7LDI, is active 24 hours a day, both on VHF at 144.650 and on HF with the following schedule:

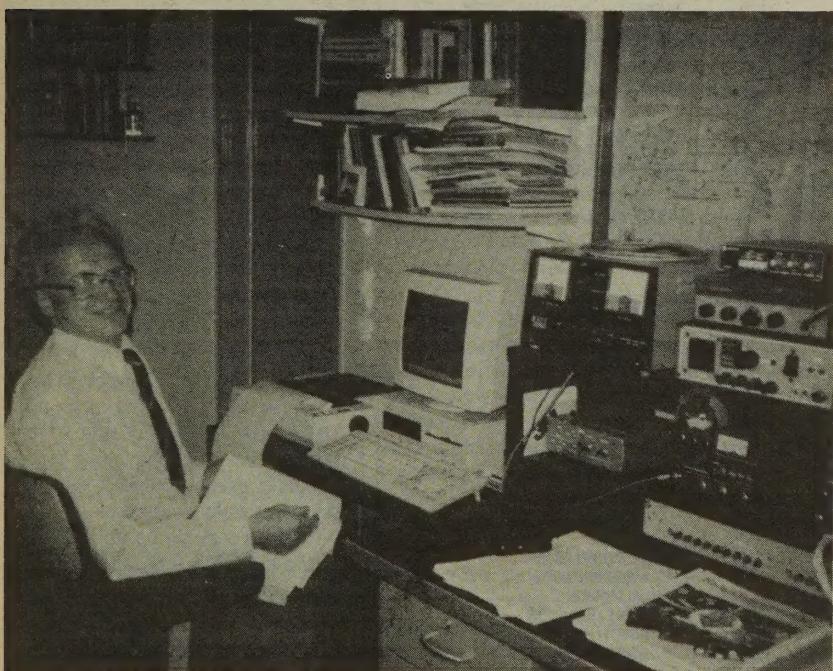


Photo A. A famous guest in the shack of G3LDI: Leo UA3CR spent a day with me looking at my packet gear, printing out lots of files and putting the information to good use when he arrived home. I now forward with Leo on 21.105 MHz regularly.

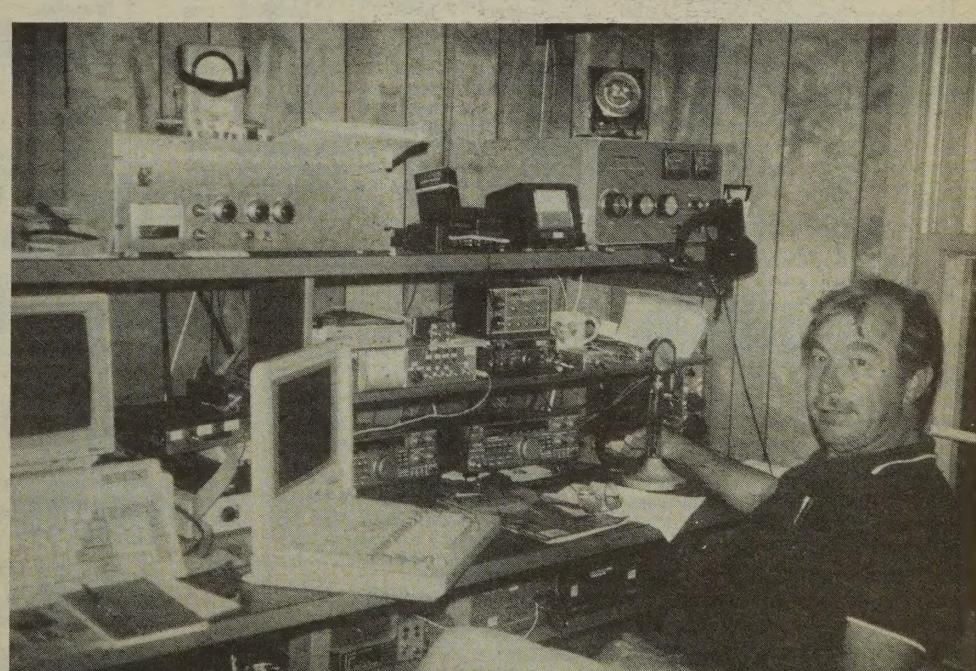


Photo B. Jack Colsen W3TMZ who is also heavily involved with AMSAT NA. Jack was responsible for starting G3LDI on HF packet several years ago and is his present forwarding partner on 21/14MHz.



**editor/publisher**  
Wayne Green W2NSD/1  
**editor/associate publisher**  
David Cassidy N1GPH

**managing editor**  
Bill Brown WB8ELK  
**production editor**  
Hope Currier  
**editorial associates**

Sue Jewell  
Joyce Sawtelle  
**contributing editors**  
Mike Bryce WB8VGE  
Joseph E. Carr K4IPV  
Michael Geier KB1UM  
Carole Perry WB2MGP  
Jeffrey Sloman N1EWO  
Gordon West WB6NOA

**advertising sales  
representatives**  
Dan Harper  
Sue Colbert  
**advertising coordinator**  
Judy Walker  
603-924-0058  
800-274-7373  
FAX 603-924-9327

**graphic design**  
Suzanne Self  
**desktop page make-up**  
Linda Drew  
Alice Scofield

**circulation manager**  
Harvey Chandler  
**subscription services**  
800-257-2346

**Wayne Green, Inc.**  
**editorial offices**  
Radio Fun  
70 Route 202-North  
Peterborough, NH 03458  
603-924-0058  
FAX: 603-924-9327

RADIO FUN (ISSN 1055-887X) is published monthly by Radio Fun, a division of Wayne Green, Inc., 70 Route 202-N, Peterborough, NH 03458. Subscriptions: \$14.00 per year. Canada add \$8.00. Foreign add \$12.00 surface/\$32.00 airmail. Second class postage pending at Peterborough NH and additional mailing offices.

POSTMASTER: Send address corrections to RADIO FUN, P.O. Box 4926, Manchester NH 03108.

Entire contents ©1992 by Radio Fun. No part of this publication may be reproduced without written permission of the publisher.

## letters



Write to: Radio Fun, 70 Route 202-N, Peterborough, NH 03458

**Bob and Rich Howard, Longmont CO** I just wanted to send you a note to tell you what a help 73 Amateur Radio Today and Radio Fun have been to my son and me. It all started in September when my son Richard and his buddy went to a hamfest to look at CB gear. They met and talked to a local ham and their interest was piqued. My son came home all enthused about learning amateur radio.

We used the Reader Service cards in your magazines to obtain information on equipment from your advertisers. The advertisers we called for even more detailed information were very helpful. As of right now, we have purchased over a thousand dollars worth of equipment from them and will probably double that within the next couple of months.

My son and I have joined the Longmont Amateur Radio Club and have both passed our license exams. I have passed full Technician and Rich has passed the No-Code Tech and is still working on passing the code exam. We are working with two of his friends to get them through Novice or No-Code Tech also.

Thanks for being such a great help and source of information for us. We would never have gotten this far as fast as we did, without you and your advertisers.

**Bob and Rich—Thanks for all your kind words about 73 and Radio Fun, and thanks also for letting our advertisers know that you're a 73/RF reader. Advertisers really do listen to their customers, and the best way you can help us bring you bigger and better publications is to let the advertisers know which magazines you read.**

Though you don't mention your son's age, your letter brings up a great part of amateur radio that too often gets overlooked: Ham radio is a great hobby for parents and children to share. In this day of single parents or households where both parents work, it gets harder and harder for parents to find the time and energy to spend with their kids. After a long day at work, and with a weekend full of chores, spending time with your children often falls into the "I know I should, but" category. A hobby like amateur radio is perfect for building bonds that will last a lifetime.—David N1GPH

**Grady W. Eaton KD4CEE, Milton FL** I cannot hold back any longer. I must reply to the letter you received from a petty officer first class in Uncle Sam's Navy (October 1992). First of all, if I were in charge I would look favorably on an ET1 who held a ham license. It sort of goes together like grits and gravy.

I spent a few years (23) in Uncle Sam's cruise service and my rate was a far cry from the electronics field. Sure, every once in awhile I could remember P-I-E and E-I-R, but that was it. So, I can't drum up a whole bunch of sympathy for a person in the electronics field having some problems with obtaining a ham license. An ET1 is in a most advantageous position to

engage in this hobby.

I continue today to work in my Navy rating with a hammer, cold chisel and a good pair of pliers (aircraft mechanic). Each day going to work I pass, and become envious of, three great big towers with all sorts of antenna wire strung between them and some beams and verticals, etc. I know that they all aren't TV antennas. The sign says "Ground Electronics." I'm sure the place is full of ETs. So write the ARRL for more information. You don't know what you're missing.

**George Therien, North Providence RI** My first radio sent by common carrier was damaged when I sent it to a repair facility. The carrier's insurance refused the claim, saying that the radio wasn't packaged properly.

I've overcome that problem by using spray foam insulation as packaging material.

The way to do it is to get a box about four inches bigger than the radio. I spray about two inches of foam into the box. THEN place the radio in a plastic bag and set it into the foam. I place another bag over the radio and spray the foam over the top of the radio and down the sides about two inches. I then let it set for 24 hours. After that it's ready to seal and ship to the repair facility.

**George—Thanks for the tip. We should also remind everyone that it's always a good idea to save the original box(es) your gear was packed in. Place the item in the original box, with all of the original packing material, then place it in a larger box with more packing foam or some of the stuff George uses. That should ensure that your equipment gets to where it's going in one piece.—David N1GPH**

**Subscribe  
To  
Radio  
Fun  
Call  
1-800-  
257-  
2346**

# MFJ's world famous Ham Radio Accessories

**Why do more hams throughout the world  
use MFJ accessories than any other brand?  
Because they are value packed and carry  
MFJ's one year unconditional guarantee!**

## MFJ Speaker Mics

**Compact or miniature models for all popular HTs**

**Compact Speaker Mics, \$24.95 each:**

MFJ-284 or MFJ-286

**\$24.95**

Once you try an MFJ Speaker Mic you'll never want to be without it. You'll be able to carry your handheld on your belt and never have to remove it to monitor calls or talk.

You'll never have to turn up your audio annoyingly loud to monitor calls because it's handy lapel/pocket clip lets you keep it close to your ear for easy listening.

And you'll never have to clumsily remove your handheld from your belt holder to talk because you can conveniently take the speaker mic in one hand, press the push to talk button and talk. Measure 1 1/4" x 2" x 3".

They come with a lightweight retractable cord that eliminates the dangling cord problem. They feature excellent audio on both transmit and receive. MFJ-284 for Icom or Yaesu; MFJ-286 for Kenwood.

**Miniature Speaker Mics, \$24.95 each:**

MFJ-283, MFJ-285, MFJ-285L, MFJ-287 or MFJ-287L

**\$24.95**

New miniature speaker mics pack all the features of the compact models into a tiny 2" x 1 1/4" x 1/4" package. The lapel pocket clip swivels for even more convenient positioning. Also features transmit LED. Choose from regular or "L" shaped connector. Order MFJ-285 or MFJ-285L for Icom or Yaesu, MFJ-287 or MFJ-287L for Kenwood. MFJ-283 for dual plug Alinco.

## Deluxe 300 W Tuner



**MFJ-949D** is the world's most popular 300 watt PEP tuner. It covers 1.8-30 MHz, gives you a new peak and average reading Cross-Needle SWR/Wattmeter, built-in dummy load, 6 position antenna switch and 4:1 balun -- in a compact 10 x 3 x 7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, \$12.95.

## SWR Analyzer

**MFJ's innovative new SWR Analyzer gives you a complete picture of your antenna SWR over an entire band -- without a transmitter, SWR meter or any other equipment!**

Simply plug your antenna into the coax connector, set your SWR Analyzer to the frequency you want and read your SWR. You can instantly find your antenna's true resonant frequency, something a noise bridge can't do. Covers 1.8-30 MHz (or choose MFJ-208, \$89.95 for 2 Meters). Use 9 V battery or 110 VAC with MFJ-1312, \$12.95.

## VHF SWR/Wattmeter

**MFJ-8128**  
**\$29.95**

Covers 2 Meters and 200-30 or 300 Watt scales. Also reads relative field strength 1-170 MHz and SWR above 14 MHz. 4 1/2 x 2 1/4 x 3 in.

## MFJ Multiple DC Outlet

**MFJ-1112**  
**\$29.95**

New MFJ DC Power Outlet saves you space and money. Hook it to your 12 VDC power supply and get 6 DC outlets for connecting your accessories. RF bypassing keeps RF out of power supply from DC line outlet. 13 1/2 x 2 3/4 x 2 1/2 in.

## 12/24 Hour LCD Clocks



**\$19.95** MFJ-108B

**\$9.95** MFJ-107B

Huge 5/8 inch bold LCD digits let you see the time from anywhere in your shack. Choose from the dual clock that has separate UTC/local time display or the single 24 hour ham clock.

Mounted in a brushed aluminum frame. Easy to set. The world's most popular ham clocks for accurate logs. MFJ-108B 4 1/2 x 1 x 2; MFJ-107B 2 1/4 x 1 x 2 in.

## MFJ Cross-Needle SWR/Wattmeter

MFJ-815B

**\$69.95**

MFJ Cross-Needle SWR/Wattmeter has a new peak reading function! It shows you SWR, forward and reflected power in 2000/500 and 200/50 watt ranges. Covers 1.8-30 MHz.

Mechanical zero adjusts for movement. SO-239 connectors. Lamp uses 12 VDC or 110 VAC with MFJ-1312, \$12.95.

## Deluxe Code Practice Oscillator

**MFJ-557** Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base so it stays put on your table. Portable because it runs on a 9-volt battery (not included) or an AC adapter (\$12.95) that plugs into a jack on the side.

Tone and Volume controls for a wide range of sound. Speaker, earphone jack. Key has adjustable contacts and can be hooked to transmitter. 8 1/2 x 2 1/4 x 3 1/4 in.

Nearest Dealer/Orders: 800-647-1800

**MFJ ENTERPRISES, INC.**  
Box 494, Miss. State, MS 39762  
(601) 323-5869; FAX: (601) 323-6551  
TELEX: 53 4590 MFJ STK

• One year unconditional guarantee • 30 day money back guarantee (less s/h) on orders from MFJ • Add \$5.00 each s/h • FREE catalog

**MFJ . . . making quality affordable**

# Refrigerant Pipe J-Pole

Too easy to be true!

by Dave Curtis NGØX

This J-pole is a simple, cheap, quick-to-build and unobtrusive antenna for the 2 meter band. When I moved into my new town house, making a little racket on packet was my first ham radio priority. There were two problems I needed to solve to get RF into the air. First, the association covenants for my new QTH allow antennas (thankfully!), but only those that cannot be seen from ground level in front of the complex. That meant that a small, unobtrusive skyhook was the order of the day. Secondly, cash outlays had to be kept to a bare minimum. (Alas, the new town house came with a new mortgage.) This J-pole is small and skinny and very frugal. Build one—you'll like it.

## What's a J-Pole?

A J-pole is a vertical half-wave dipole, end-fed through an impedance-matching stub. This may not be obvious the first time you see one because mechanically all of the pieces run together. In fact, in this design both the antenna and the matching section are made of one continuous piece of copper pipe.

Here's how a J-pole works (see Figure 1): The top two-thirds of the antenna are a simple half-wave dipole, radiating a vertically polarized signal because of its vertical orientation. Because it is one-half wavelength, there is no need for ground plane spokes of any kind. The catch

is that since the dipole is being fed from the end rather than from the middle, it presents a very high impedance to the feedline. That's where the bottom one-third of the J-pole comes in—it is really a transmission line one-quarter wavelength long. This section of transmission line acts as a transformer, changing the high impedance of the end-fed dipole into an impedance that will match the coax.

Oh, there is just one more catch: The transmission line transformer is a balanced feedline, and in order to hook up with an unbalanced coaxial feedline you need a balun. One of the simplest and cheapest balun designs for frequencies in the VHF range is the coaxial loop balun. All it takes to build one is an electrical half-wavelength of coax and a little solder.

## Design

With most antennas, deciding the electrical configuration and calculating critical dimensions are only the beginning. Sound mechanical design is what makes an antenna successful—and the simpler the better. In my J-pole, the dipole and transformer line are made out of one continuous piece of 3/8-inch copper refrigeration tubing. Refrigeration tubing comes in several sizes; 3/8-inch seemed to be a good compromise between workability and rigidity. The local home improvement center sells it for 69 cents per foot.

For the support structure, I used that good old standby, PVC plumbing. Where would hams be without plastic pipe? A 10-foot length of 3/4-inch pipe cost me under a buck. Easy to work, with reasonably good insulation properties, PVC pipe has to be the eighth wonder of the ham world!

A few feet of pipe and three T-joints built a support that fit the low profile requirements of my installation. Figure 2 shows my support design. The antenna element is attached to the support by machine screws in three places: one screw at the bottom center of the transformer section, and two at the other end of the transformer section. Feel free to improvise what you need to fit your installation. The main goal is to hold the transformer section secure, maintaining even spacing. Just about any support that fits your situation will work as long as it is mechanically sound and is insulated from the antenna.

## Construction

Since I built this antenna for packet, the dimensions shown are for a design frequency of 145.0 MHz. For other frequencies, calculate your own dimensions using the formulas shown in Figure 1. Grab a permanent mark-

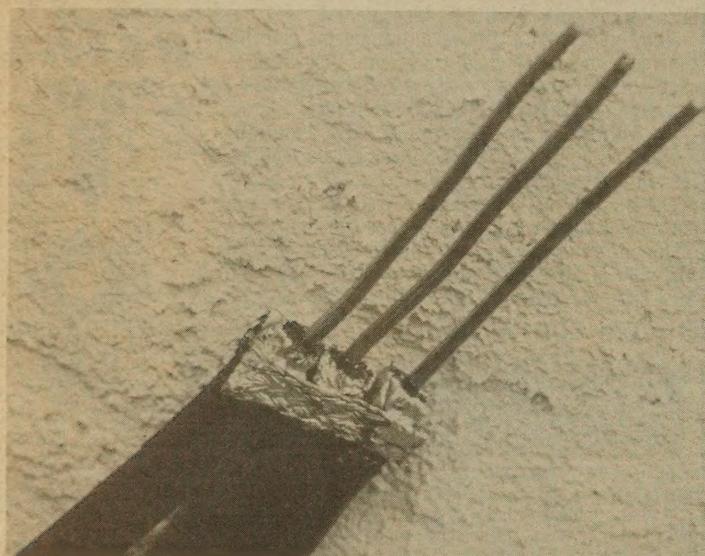


Photo A. Short all three braids together.

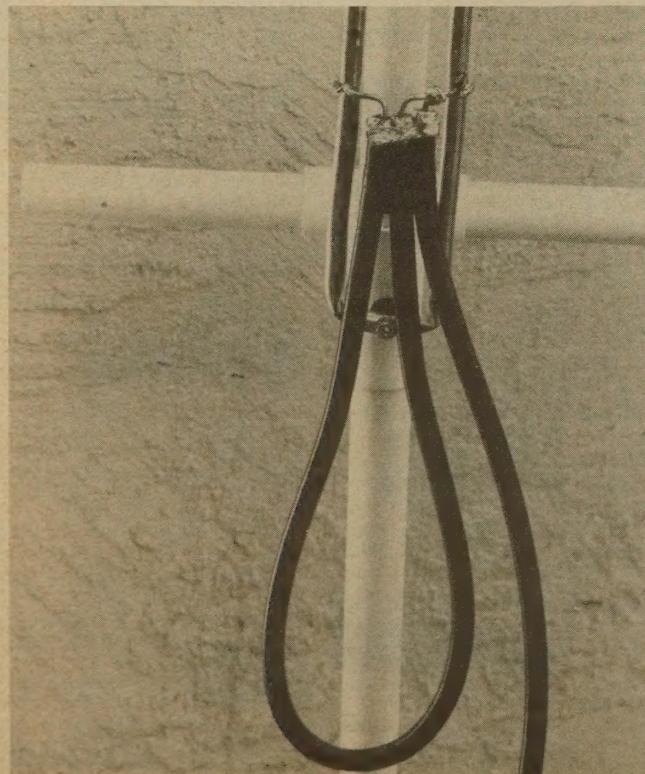


Photo B. Feedline attachment.

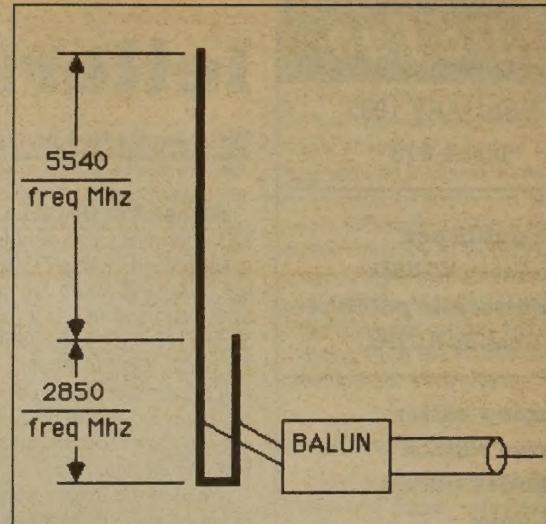


Figure 1. Basic J-pole dimensions.

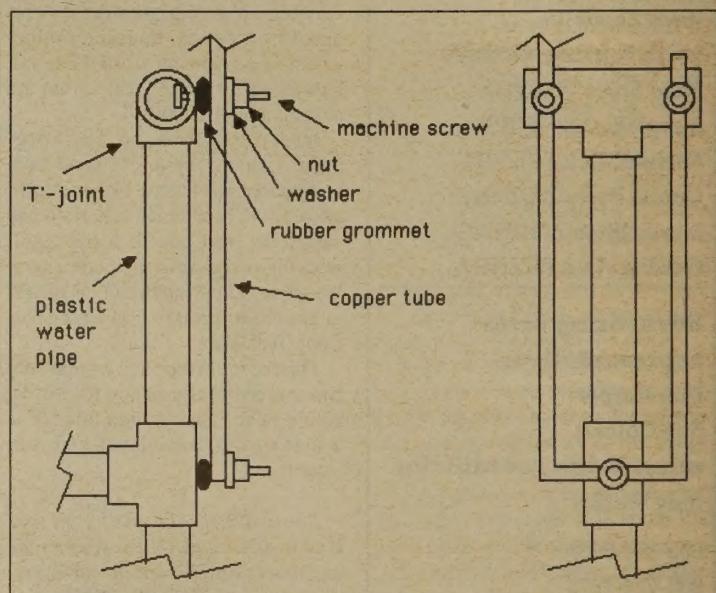


Figure 2. Rough sketch of support structure (not to scale).

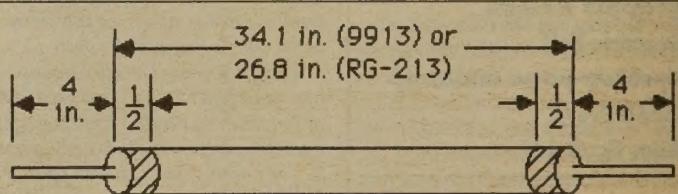


Figure 3. Balun dimensions for 145.0 MHz.

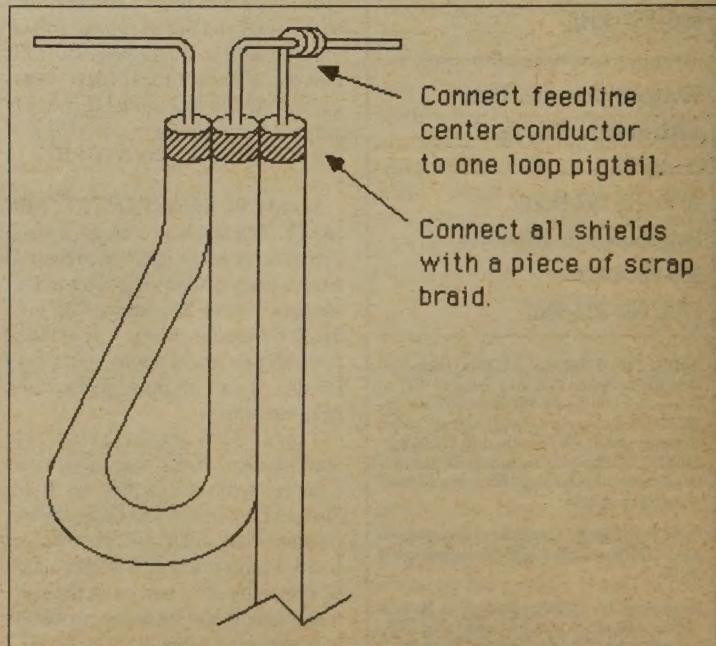


Figure 4. Balun assembly.

er that will write on copper, then lay out your measurements on the copper tube. Put a mark at one-quarter wavelength, then put a mark three inches farther up to allow for the stub end, then measure another three-quarter wavelength and mark the top. Cut off the tube at your top mark.

Bend the tube at the stub marks, forming the antenna into its characteristic "J" shape. Without tube-bending tools you will squash the corners a bit, but that's OK—the electrons don't mind. Don't worry if your spacing is not exactly the same as mine. It will make a difference in the exact impedance of the transmission line, but the differences will be tuned out anyway, so the exact number doesn't matter. Just make sure that your support holds the two sides of the transmission line parallel. Drill holes to fit your support, then mount the antenna.

A J-pole needs a balanced feed, so some kind of balun is required to mate to coax. The simplest way to go for a 2 meter antenna is a coaxial cable loop balun. The loop is made of an *electrical* half wavelength of coax, which is shorter than the free-space half-wave formula because the wave travels more slowly in coax. The actual speed is expressed as a velocity factor, which is the fraction of the free space speed of light that waves travel in the coax. The velocity factor depends mainly on the insulator used in the coax. For RG-213, the velocity factor is 0.66; for Belden 9913 (which I used), it is 0.84, so my loop is (0.84)(5892/145.0 MHz), or 34-1/8 inches.

Cut the loop as shown in Figure 3. When you strip the ends, save the braid scraps. They will be used to make the loop braid connections. Prepare the end of your feedline by stripping back the braid and dielectric as you did for the loop. Tin the braids of all three prepared coax ends. Flatten two scraps of braid, then tin them. Form the loop into a "U" shape, shorting the braids at each end together and making the pigtails parallel. Lay the feedline alongside in parallel; its braid should short the loop braid. Use the tinned braid scraps to short the three coax braids and solder them together as shown in Photo A. Bend the loop pigtails out to opposite sides, forming a "T." One loop pigtail will cross over the feedline pigtail. Wrap the feedline pigtail around it a couple of times, trim off the excess, and solder as shown in Figure 4. This is a good time to get out your ohmmeter and make sure that the center conductor has not been accidentally shorted to the braid by excess heat or other mishaps.

After you've completed the balun, it's time to tune up. J-poles are dead easy to tune if you have an SWR meter. The matching section that forms the bottom third of your antenna is an impedance transformer that gives you any impedance you want. At the top end, where it joins the half-wave antenna section, it has a very high impedance. At the bottom end, it is shorted (zero impedance). Somewhere in between is the sweet spot that exactly matches your feedline. You can easily find it by looking for a low SWR.

Insert your SWR meter close to the antenna. Scrounge a couple of plastic spring clamps or some equiv-

alent nonconductive device to temporarily hold the balun's pigtails to the J-pole. You want to get good contact while making test transmissions. Start four inches up from the bottom and search for a spot that gives you low SWR. (Don't transmit while moving the taps!) You should be able

to get very close to 1:1. Mark the tap points.

Every good solder joint starts with a good mechanical connection, so drill holes at your tap points to accept the balun's pigtails. Pass the pigtails through, twist them back, then solder. See Photo B. Strap the

coax to the support with cable ties or electrical tape, then give the antenna one final test. At this point it's all ready to go except for one thing: The coax ends should be moisture-proofed. The simplest way is to goop some coax connector sealant onto the ends.

## Put it Up!

Hey! It's ready to go up in the air! And what did it cost? Five bucks for copper tube, three for plastic pipe and fittings, plus a few cents for miscellaneous screws and solder and so forth, and that's it. Definitely a competitive dollar-per-dB ratio. **RF**

# ASTRON CORPORATION

9 Autry  
Irvine, CA 92718  
(714) 458-7277



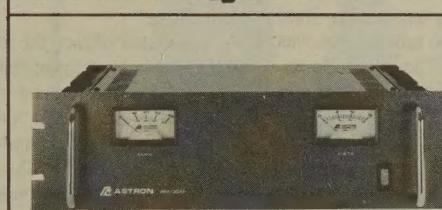
MODEL VS-50M



SL SERIES



RS-L SERIES



RM SERIES

MODEL RM-35M



RS-A SERIES

MODEL RS-7A



RS-M SERIES

MODEL RS-35M



VS-M AND VRM-M SERIES

MODEL VS-35M



RS-S SERIES

MODEL RS-12S

## ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

### SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

### PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC  $\pm$  0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

### • LOW PROFILE POWER SUPPLY

MODEL	Colors	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
SL-11A	• •	7	11	2 $\frac{3}{4}$ x 7 $\frac{1}{2}$ x 9 $\frac{1}{4}$	11

### • POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-4L	3	4	3 $\frac{1}{2}$ x 6 $\frac{1}{2}$ x 7 $\frac{1}{4}$	6
RS-5L	4	5	3 $\frac{1}{2}$ x 6 $\frac{1}{2}$ x 7 $\frac{1}{4}$	7

### • 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12A	9	12	5 $\frac{1}{4}$ x 19 x 8 $\frac{1}{4}$	16
RM-35A	25	35	5 $\frac{1}{4}$ x 19 x 12 $\frac{1}{2}$	38
RM-50A	37	50	5 $\frac{1}{4}$ x 19 x 12 $\frac{1}{2}$	50
RM-60A	50	55	7 x 19 x 12 $\frac{1}{2}$	60

### • Separate Volt and Amp Meters

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12M	9	12	5 $\frac{1}{4}$ x 19 x 8 $\frac{1}{4}$	16
RM-35M	25	35	5 $\frac{1}{4}$ x 19 x 12 $\frac{1}{2}$	38
RM-50M	37	50	5 $\frac{1}{4}$ x 19 x 12 $\frac{1}{2}$	50
RM-60M	50	55	7 x 19 x 12 $\frac{1}{2}$	60

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-3A	•	2.5	3 x 4 $\frac{1}{2}$ x 5 $\frac{1}{4}$	4
RS-4A	• •	3	3 $\frac{1}{2}$ x 6 $\frac{1}{2}$ x 9	5
RS-5A	• •	4	3 $\frac{1}{2}$ x 6 $\frac{1}{2}$ x 7 $\frac{1}{4}$	7
RS-7A	• •	5	3 $\frac{1}{2}$ x 6 $\frac{1}{2}$ x 9	9
RS-7B	• •	5	4 x 7 $\frac{1}{2}$ x 10 $\frac{1}{4}$	10
RS-10A	• •	7.5	4 x 7 $\frac{1}{2}$ x 10 $\frac{1}{4}$	11
RS-12A	• •	9	4 $\frac{1}{2}$ x 8 x 9	13
RS-12B	• •	9	4 x 7 $\frac{1}{2}$ x 10 $\frac{1}{4}$	13
RS-20A	• •	16	5 x 9 x 10 $\frac{1}{2}$	18
RS-35A	• •	25	5 x 11 x 11	27
RS-50A	• •	37	6 x 13 $\frac{1}{4}$ x 11	46

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-12M	9	12	4 $\frac{1}{2}$ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10 $\frac{1}{2}$	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 $\frac{1}{4}$ x 11	46

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
VS-12M	9 5 2	12	4 $\frac{1}{2}$ x 8 x 9	13
VS-20M	16 9 4	20	5 x 9 x 10 $\frac{1}{2}$	20
VS-35M	25 15 7	35	5 x 11 x 11	29
VS-50M	37 22 10	50	6 x 13 $\frac{1}{4}$ x 11	46

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
VRM-35M	25 15 7	35	5 $\frac{1}{4}$ x 19 x 12 $\frac{1}{2}$	38
VRM-50M	37 22 10	50	5 $\frac{1}{4}$ x 19 x 12 $\frac{1}{2}$	50

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-7S	• •	5	4 x 7 $\frac{1}{2}$ x 10 $\frac{1}{4}$	10
RS-10S	• •	7.5	4 x 7 $\frac{1}{2}$ x 10 $\frac{1}{4}$	12
RS-12S	• •	9	4 $\frac{1}{2}$ x 8 x 9	13
RS-20S	• •	16	5 x 9 x 10 $\frac{1}{2}$	18

\*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

# Hawaiian Hams Respond to Iniki Devastation

by Ann Shaver AH6KY

Before the Civil Defense sirens began wailing to alert the public to the approach of Hurricane Iniki, Wayne Jones NH6GJ, Hart Akagi KH6BIO, and other members of Honolulu's Emergency Amateur Radio Club (EARC) knew they would be able to handle whatever nasty surprises the storm might throw them. "After all," Jones remarked, "we have fun but we take Field Day seriously."

The Category 4 hurricane had flirted with the Hawaiian Islands for several days. After taking a turn away from the state on Tuesday, Iniki gathered strength, changed course and on Thursday night headed toward Oahu, the most populous of the eight major islands. That was when Jones, President of EARC and

County RACES (Radio Amateur Civil Emergency Service) Coordinator, Robin Liu AH6CP, trustee of the State RACES repeater system, and other volunteers headed to the command post in the basement of Honolulu Hale (City Hall). Numerous other amateur groups and unaffiliated hams pitched in to do what they could to lessen the suffering before, during and after the storm, which damaged Oahu's Waianae Coast and devastated the neighboring island of Kauai.

"We're well organized here at Navy MARS," explained William Boykin W6HTH. "As soon as we learned Iniki was heading our way, we followed our procedure and established our emer-

gency net. Each of us knew whom to call and what to do." Almost incredibly (but then, that's part of what amateur radio is all about!), John Porter NH6TL continued participating in the net while the storm raged at his Kapaau, QTH.

"It may sound trite," half-apologized Pat Corrigan KH6DD, a State Civil Defense leader, "but we amateurs were the only ones up on the circuits. In the first hours, everything went down. We in the amateur radio community were the only means of communication."

## Governor and Mayor Confer on 2 Meters

Indeed, the first contact between the Governor of Hawaii and the Mayor of Kauai was via an amateur 2 meter repeater. Landlines and cellular circuits on Kauai were destroyed by the storm, but the KH6JPL repeater, located on Oahu's Waianae Coast, functioned during the entire emergency.

The aftermath of the storm also demonstrated the value of digital communications. Corrigan specifically lauded the local packet cluster: "It showed its full capabilities. We had communications from the very beginning—real time, hard copy. The information was extremely reliable. The operation enhanced our reputation with State and County Officials."

Amateur traffic sent via satellite also moved expeditiously. "UO22 did a great humanitarian service in connection with the hurricane disaster. For the first time, I believe, a PACSAT (packet satellite) was used for health-and-welfare traffic," explained Dave Medley KI6QE, Satgate coordinator. "This has been so smooth and effective that I doubt many users of UO22 have noticed that this is going on. Working in conjunction with an HF BBS network, messages are collected from all over the USA. Some are sent direct to the stricken area via 15 meter packet while others are sent via UO22 to Honolulu, where they are distributed from a central point via ham radio or Navy MARS."

"In the future it is expected that more use will be made of the PACSATS for this kind of traffic, as this demonstration of the capability of UO22 has been

very successful. During the short period that UO22 was down, messages were uploaded to LUSAT, which once more came to the rescue as the good reliable backup that it is."

## Inbound Traffic Stresses System

Perhaps the system's success in passing traffic led to its biggest weakness: Many observers noted that health-and-welfare traffic was not always passed expeditiously. Almost immobilized by the storm's wrath, Kauai was not in a position to accept the volume of non-critical, non-vital traffic coming its way. When carrying out the essential functions of daily life became extraordinarily difficult given the lack of electricity, ruined housing, shortage of gasoline, impassable roads, and so forth, well-meant traffic became a burden.

Indeed, several hams noted that the structure that had functioned so well in the early hours of the hurricane's aftermath began to fall apart after the critical phase had ended. As one ham delicately phrased it, the ARRL was "invisible" in supporting everything being done. John Elliott AH6BJ elaborated: "Health-and-welfare traffic is an ARES (Amateur Radio Emergency Services) activity, strictly an ARRL function. The RACES mission is emergency, critical and official traffic. When commercial communications are restored, the RACES mission becomes zilch. Then it reverts to ARES, which is strictly an ARRL function. Unfortunately, there was no ARES structure to interface with the Red Cross."

As a matter of fact, the Red Cross itself came in for a lot of criticism from hams who were involved in Hurricane Iniki and its aftermath. "Our building was hit hard. Eight ground-floor units were wiped out," said Al Shaver AH6KX, describing damage to a condo on Oahu's leeward coast. "We reported our damage to Civil Defense Friday afternoon, just after the 'all-clear' was given. We didn't see anyone from the Red Cross until Tuesday. Then, for three straight days, Red Cross volunteers came by asking us the same questions: What happened? How did you respond? They never offered us any assistance whatsoever."

## Hams Fly to Kauai

Several Oahu hams traveled to Kauai on military transports shortly after the storm hit. Many of them reported that

Red Cross officials seemed to have little understanding of the role of communications volunteers and assigned them, instead, to clean-up crews. "I couldn't get leave from my job, but I volunteered to go to Kauai Friday night and stay 'til Sunday evening," mentioned Bill Rhoden AH6IH. "I'm sure some relief workers there would have appreciated going home for the weekend."

"I offered to help expand their packet capabilities or help in any other way with their communications. I was told that if I couldn't stay a week, they didn't want me at all."

Tony Dacres AA8EI, who came to Hawaii via Guam (and Typhoon Omar) to serve as Red Cross Communication Coordinator, presents a different view: "There was no way (on Kauai) to distribute any incoming traffic. The official Red Cross position was that outgoing traffic was to be encouraged, since that probably eliminated several incoming messages once the off-island family heard from the person on Kauai. In the time I was there, I became aware of a serious problem with hams and the Red Cross with respect to handling health-and-welfare traffic, and a more serious situation locally."

"In my opinion, some education is necessary in both directions—and some cross pollination of message formats—ham, Red Cross and MARS. There was a lot of misunderstanding and hurt feelings. Since I took much of the lightning, I want to try to do something about it before the next disaster. I do hope you all are spared, but since we know something will happen somewhere, it behooves us to act now."

"Lack of standardized message formats made our job much more difficult," mentioned Boykin, referring to his experiences receiving NTS messages passed by Hal Sprague KH6GPI, operator of one of Oahu's most active packet BBSs. "I spent so much time translating these messages into MARS format. I passed 386 messages to Kauai and I had to go into each one and reformat it for the MARS operators. It was really disgusting to have to waste valuable time."

"The big problem is that there was no PIC, person in charge," observed Corrigan, of State RACES.

Coordinated or not, many individuals stepped in and provided necessary and appreciated services. One of the first to reach Kauai was Jerry Wine KH6UH. In addition to providing an ar-

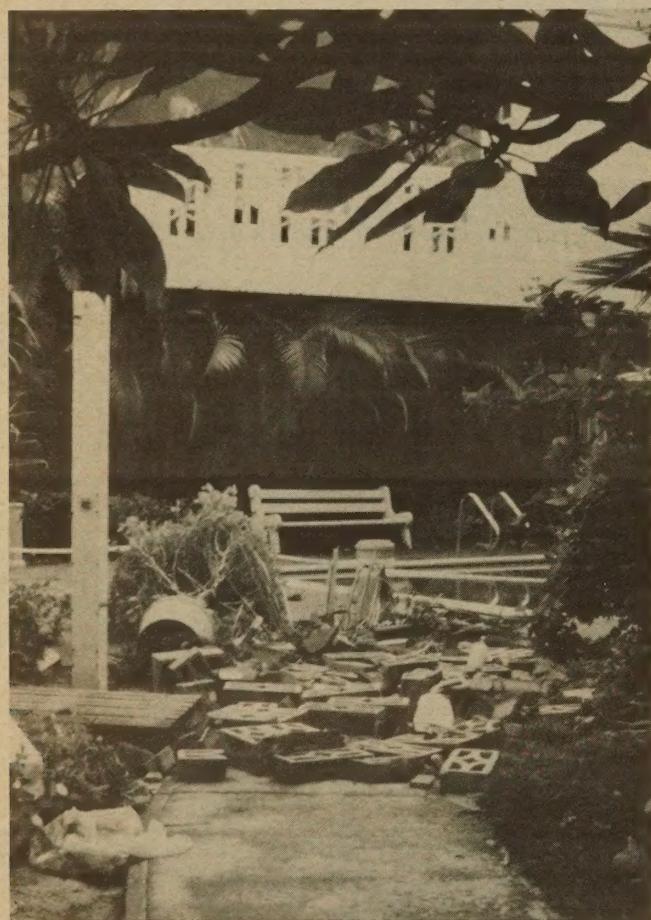


Photo A. Concrete blocks from the seawall were propelled toward the swimming pool at this Oahu QTH.



Photo B. Jerry Wine KH6UH spent several days on Kauai using his radio skills to assist with disaster relief.

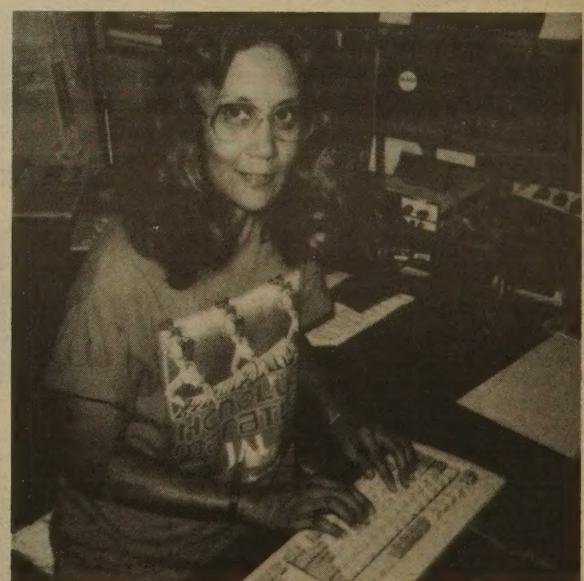


Photo C. Nani Rhoden AH6II found digital communications to be a very reliable way of passing health-and-welfare traffic. (Photo by AH6IH.)

ray of communications services, Wine shot some fascinating video footage of the destruction and subsequent relief efforts. Joe Keola KH6BFZ left the comforts of his Oahu home, untouched by Iniki, and went to Kauai the night of the storm. He set up an emergency HF station and provided some of the island's first communications with the rest of the world.

Chuck Burch AH6IN, Lee Wical KH6BFZ, and Bill Rhoden AH6IH on Oahu coordinated many of their HF messages with Keola. "Between Nani AH6II and me, we handled 147 H-&W messages from his station. He is a perfect communicator. If I ever have another emergency situation, I hope he is around to be on the other end of my transceiver." Burch and Wical reported handling similar amounts of traffic as well as numerous phone patches to the U.S. mainland.

#### Hams Help Each Other

Countless other hams carved low-profile niches in which to be of service. Sunday morning, less than 48 hours after the cataclysmic storm, Philip Naone NH6QO knocked on our door. "I talked with your friend Brian ZL1AIR in New Zealand last night. He had heard about the storm and, of course, was concerned about you.

"I told him I had heard the damage report you gave Friday night on the JPL repeater. I knew you and Al were OK but your building had a lot of damage. Brian wants to talk with you tonight at 0700Z so I brought my tools and a lot of coax with me. Let's get your antenna back up."

On the island of Maui, Ken Arck, Bill Heyde KH6UU, and other members of the Maui Amateur Radio Club used both packet and the statewide RACES repeater system to send over 400 messages from concerned Maui friends and relatives. Arck reports that Maui county officials didn't recognize or appreciate their service. "A lot of us really worked our butts off (that) weekend and nobody seems to care that we did."

Paradoxically, many helped by maintaining radio silence except when actually needed. "I want to thank you guys who just kept quiet," Akagi mentioned at an EARC meeting two weeks after Iniki struck. "You kept the clutter off the air. Everyone appreciates your cooperation."

Clearly, amateur radio operators provided a real service during Hurricane Iniki. Afterwards, their activities provided comfort and solace to the victims and those concerned about the victims. "Just to hear the smiling voices of the loved ones on the mainland when we called them at 2 o'clock in the morning was rewarding enough for Nani and me," expressed Rhoden.

Equally clearly, many steps need to be taken before the next emergency situation. Much of the confusion, inaction and duplication of activity can be prevented or significantly reduced through careful planning. Better understanding of each other's roles, as well as better fulfillment of assigned functions, will reduce bad feelings and—more important—provide better and more timely service. Nonetheless, most agree that Hawaiian hams functioned remarkably well under the circumstances.

"After all, what do you expect?" laughed Elliott, injecting a note of levity into an otherwise serious discussion. "There's a reason they call them disasters!"

#### Be Prepared!

As every good Scout remembers, be prepared! But what does emergency preparedness mean to the radio amateur? Below are several tips—some of which seem blatantly obvious—to help you be ready when an emergency strikes your community.

Although I considered myself a person very interested in emergency preparedness, I must confess that not until Hurricane Iniki was bearing down on Oahu did I realize how unprepared

I actually was. What I learned during this disaster could help you.

**1. Charge!** When the warning sirens for Hurricane Iniki sounded, I immediately began charging all my NiCds. Fortunately, we didn't lose power for four hours, so I had just enough time to get everything fully charged. But what a silly gamble that was. What if our commercial power had failed sooner?

Don't wait until an emergency is imminent. Keep NiCds, car batteries and other auxiliary power sources ready to be used at all times. And while you're

at it, be sure you know how to switch from commercial power to your emergency sources. Be able to do this quickly and easily, by flashlight and with distractions. Make sure positive and negative connections are clearly marked—a "small" mistake can wipe out your system just when you need it most!

**2. Plan.** Consider the various types of disasters which might hit your locale and develop a personal plan of action. Beyond natural disasters, what else could affect you? Are there chemical factories, dams, or nuclear facilities that might

suffer a calamity? Is there a dormant volcano (there's a big difference between dormancy and extinction!)? What about a hazardous spill from trucks or trains passing through? Know what the correct response is for readying your home for a tornado, a flood, a wildfire, an earthquake, etc. Obviously, some disasters, such as avalanches or hazardous leaks, strike without warning; others, such as hurricanes or volcanic eruptions, usually can be anticipated several hours in advance. Each kind demands its own specific readiness. Should you open

# THE CATALOG OF BARGAINS!

Order the **one and only book** that opens the world of amateur radio mail order bargains. Our third year. Discover who's who in the world of amateur radio mail order! **PLUS**...the huge RESOURCE DIRECTORY includes a List of 100+ Free Catalogs, a list of 85 BBS's, Clubs, a Directory of Worldwide QRP Clubs, the HAM-SOFT Shareware Catalog, and much more. **ALSO**...included this year is the *W6DDB Library of Tips for Hams*. Here are some of the 203 categories in the 300 pages of the 1993 AMATEUR RADIO MAIL ORDER CATALOG AND RESOURCE DIRECTORY:

Alternative Energy  
Amateur Television  
Antennas  
Antenna Duplexers  
Associations  
Auto Tags  
Award Plaques  
Balloons, Blimps  
Badges, Batteries  
BBS Listings  
Beam Headings

Belt Buckles  
Books  
Books, Braille  
Books, Soviet  
Bumper Stickers  
Calendars  
Classified Ad Publications  
Computer-to-Rig  
Interfaces  
Crystals

Digital Frequency Display  
Digital Signal Processing  
Direction Finding  
Directories  
Duplexers  
DX Guides  
Embroidered Caps  
Emergency Supplies  
Filters  
Frequency Converters  
Frequency Counters

Headphones  
Hurricane Tracking  
ID, Morse Code  
Iron Powder & Ferrite  
Keyers, Kits, Lasers  
Linear Amplifiers  
Magazines, Manuals  
Meters  
Modifications, Mugs  
Newsletters  
Online Directories

Software, Amiga  
Software, Apple  
Software, Commodore  
Software, PC  
Study Guides  
Surveillance  
Tools, Transverters  
TVI filters  
Used Equipment  
Video Cams  
Weather Instruments  
Wire & Cable

YES! I need to know Who's Who in the Business of Amateur Radio. Send me the 1993 AMATEUR RADIO MAIL ORDER CATALOG & RESOURCE DIRECTORY and Ham-Soft Shareware Catalog.

Name \_\_\_\_\_

Street Address or PO Box \_\_\_\_\_

City, State, ZIP \_\_\_\_\_

USA residents, please enclose \$14.95+\$3.00 shipping and handling, US Funds. Foreign customers, please enclose \$14.95+\$6.00 ground shipping, US Funds. USA customers: your copy of the 1993 Amateur Radio Mail Order Catalog and Resource Directory will be shipped two-day priority mail the day your payment is received. Foreign customers: your copy will be shipped First Class mail. If you prefer airmail delivery, please ask your local post office for airmail rates from USA to your destination, and enclose additional US Funds for the amount.

MAIL THIS COUPON OR PHOTOCOPY TO:  
HART PUBLISHING  
767 SO. XENON CT,  
#117RF  
LAKEWOOD, CO 80228  
303.987.1211

CIRCLE 300 ON READER SERVICE CARD



Photo D. Lee Wical KH6BZF, operating from his Oahu home, coordinated his communications with Joe Keola KH6BFZ, who hurried to Kauai.

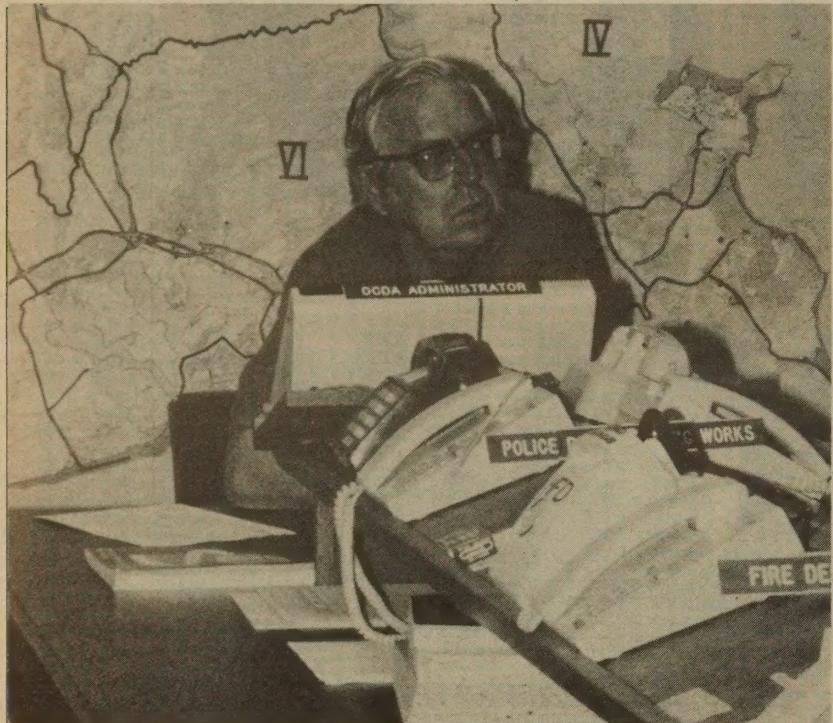


Photo E. Wayne Jones NH6GJ, president of the Emergency Amateur Radio Club, coordinated activities at Oahu's Emergency Operations Center located in the basement of Honolulu's municipal building. (Photo by N6VQE.)

windows slightly or seal everything tightly? Where should you put outdoor furniture and what should you do with pets? How will you obtain water and food if the infrastructure is seriously damaged? Should you evacuate? If so,

where to? Learn the answers to these and similar questions now.

Spend time devising your own emergency response outline. Study the details and then "fully fund" the plan, so to speak. If you should keep a supply

of water on hand, for instance, fill your containers now. Don't waste valuable time looking for flashlights, can openers, battery-operated radios and the like when an alert has been given. Rehearse your emergency response and be ready to roll (no pun) when things start to happen.

In addition to insuring the safety of yourself and your home, prepare your station for use under adverse circumstances. Be able to get on the air quickly after a catastrophe. In addition to power disruptions (which you are now prepared to deal with), antennas often suffer in disasters. Dipoles are not as glamorous as multi-element beams, but they are reliable and easy to construct and to install. Have one ready and know how to set it up, particularly if wind has blown down your usual supports.

3. **Network.** Get acquainted with your community's emergency resources. Is there an active Civil Defense organization? Are there RACES and ARES groups? What, if any, community involvement will MARS have? Is there an emergency-oriented local radio club? Introduce yourself to these entities and find out how your skills and equipment can enhance their standing plans.

Participate in emergency simulations. Accept a specific operating assignment which you are designated to fulfill in case of a catastrophe. Learn how various groups and individuals work together. Learn who responds before an emergency, who acts while the emergency is at its crisis peak, and who steps in afterwards.

In my own community, there was ill will because some people expected different responses during each of these phases than those the organizations were prepared to make. Do not expect ARES, for example, which is a non-governmental volunteer organization

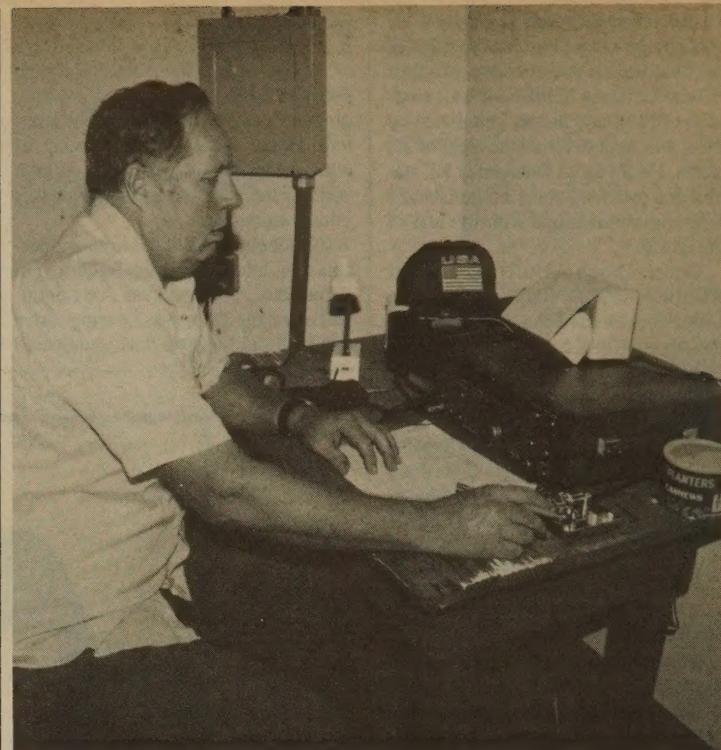


Photo F. Chuck Burch AH6IN copied Kauai traffic and informed concerned loved ones of the conditions on Kauai. (Photo by N6VQE.)

tion, to be actively involved during an emergency. Civil Defense, and RACES, its radio arm, are quasi-governmental groups authorized to act during crises.

4. **Respond.** After the actual disaster has occurred, respond rather than react. Convey important information to the proper officials. Alert them of casualties or injuries. Tell them the physical condition of your surroundings. Volunteer this information, don't wait to be asked!

Perhaps this sounds self-evident, but from personal experience I know it is not. Twice my community was severely stricken by hurricanes and twice there was little response for several days because downtown officials were not aware of our plight. Similarly, do what you can to be sure that the information is not only received but also passed on to the proper places. Immediately after the "all-clear" was sounded following Hurricane Iniki, I gave a damage assessment (after being asked for it!) to someone helping with Civil Defense communications. Although other amateurs later verified that I had made the report, responsible Civil Defense representatives told me they never received any damage reports from my neighborhood.

No sensible person looks forward to disasters, but realistic people realize that they do occur. Make sure that if you have the misfortune to be involved in some sort of mishap, you can do your utmost to be prepared.

RF



## - Packet Radio - Portable & Affordable!

- ★ Simple Installation
- ★ No External Power
- ★ Smart Dog™ Timer
- ★ Perfect For Portable
- ★ Assembled & Tested
- ★ VHF, UHF, HF (10M)

Whether you're an experienced packeteer or a newcomer wanting to explore packet for the first time, this is the solution you've been waiting for! Thanks to a breakthrough in digital signal processing, we have developed a tiny, but full-featured, packet modem at an unprecedented low price! The BayPac BP-1 will transform your PC-compatible computer into a powerful Packet TNC. Although deceptively simple in appearance, the BP-1 supports sophisticated features like digipeating, file transfers, and remote terminal access, in addition to routine message handling. Here is YOUR CHANCE to join the PACKET REVOLUTION!

Tigertronics, Inc. 400 Daily Lane Post Office Box 5210 Grants Pass, OR 97527

Just...  
**\$49.95**  
+ Shipping

GET YOURS TODAY!

Toll Free Order Line

**1-800-8BAYPAC**

(1-800-822-9722)

Available Now!

(503) 474-6700 Fax (503) 474-6703

CIRCLE 269 ON READER SERVICE CARD

# Alarm Foil Antennas

Antennas that blend into the woodwork.

by Larry Kahaner WB2NEL

While in my neighbor's house one day explaining how I can phone-patch her brother in Germany, I spied a newly installed alarm system. It was the usual type in which thin foil is taped around the window to form a closed circuit. When the window is broken, the foil circuit opens and the alarm sounds. The foil looked so pleasant and neat on her huge picture window. Since I am always looking for new types of radiators (and what ham isn't?), I wondered about alarm foil. Indoor antennas are not new to me. I had some indoor dipoles in my old apartment but they always looked so ugly and had to be removed when guests came. Perhaps foil was the cosmetic answer.

Window foil is available at Radio Shack and most hardware stores. I obtained a roll from the man who installed my neighbor's alarm. A 200-foot roll cost me about three dollars. The tape I bought has a paper backing which is peeled away,

exposing a sticky foil. I made several tests and found that the tape could be applied to a painted wall and later removed without leaving a mess. I advise against placing it on wallpaper.

My house has a crown molding on the top perimeter of the room and I applied the tape in dipole fashion, starting from the center. At the feed-point I folded the tape on itself for about one inch. The tape exhibits great strength resisting pulling apart, but will tear easily if twisted. Fold the tape at right angles to prevent the coax weight from tearing it. If you make a mistake or tear the tape, another piece overlapped will make a tight contact despite the adhesive. Check with an ohmmeter if you feel insecure. I thought of different methods of feeding and decided that the simplest was also the best. I used alligator clips from my coax. This would allow me to remove the coax without taking down the antenna.

Coax climbing a white wall leaves much to be desired.

With everything in place, I loaded up the rig. My matchbox was waiting in the wings. My transceiver loaded up easily, with an SWR of 1.7 to 1. [Ed. Note: As with any indoor antenna, it's a good idea to use minimum output power to minimize radiation hazards in your hamshack.] Since my calculations were for the center of 20 meters, I peeled and cut a little off each end until it was perfectly matched for the center of the phone portion. I tuned and heard a very strong CQ from the Midwest. I answered pessimistically and he responded with a 57 report. Other reports from that area were also encouraging.

I added some tape to the ends and pruned it for the low end of the CW segment. That afternoon I worked two G's, one I and one DK. All were better than 459 reports. It is not necessary to add and subtract tape for

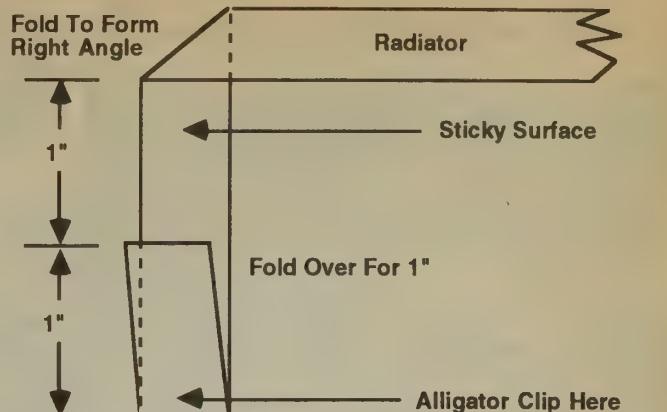


Figure 1. The coax clips onto the feedpoint connection of the alarm foil antenna. Reinforce the connection point as shown.

each segment of the band. It is as broadband as any other dipole but I felt that any extra push was helpful.

The configurations of foil antennas are limitless. If your apartment is the right size you might try putting a reflector or director on an opposing wall in another room. With a matching network you should be able to work the low bands with a shortened antenna. It would also make a great "longwire" for the SWL who is apartment bound. Even though the adage "the higher the better" still applies, if you live on the 29th floor of a 30-story apartment house, the working difference between crown molding and baseboard mounting

will be minimal. And, it will be better hidden on the baseboard. Window foil is especially good for sealing RF leaks in a home-brew chassis. And I have found that a folded dipole of foil hidden on the back of a dresser makes a fantastic antenna for commercial FM reception.

Dipoles can never compete with four-element quads up 75 feet, and indoor dipoles even less. But for the ham living in the canyons of the big city an indoor foil antenna can be the answer to never getting on at all.

Reprinted from the February 1976 issue of 73 Amateur Radio.

# BATTERIES

## REPLACEMENT BATTERIES (ALL NEW—MADE IN USA)

### ICOM

7S 13.2v 1200 mah  
8S 9.6v 1200 mah  
BP7 13.2v 600 mah  
BP8 8.4v 1200 mah

\$54.00  
\$52.00  
\$59.00  
\$59.00

SA/SAT  
BP82, BP83  
BP83A 7.2v 750 mah  
BP84 7.2v 1000 mah 3"  
BP85A 9.6v 600 mah 3"  
BP85B 12v 600 mah 3"

\$40.00  
\$69.00  
\$69.00

### KENWOOD



PB1 12v 1000 mah  
KNB4 7.2v 2200 mah  
PB6 7.2v 750 mah  
PB7 7.2v 1500 mah  
PB8 12v 800 mah

\$59.00  
\$59.00  
\$46.00  
\$55.00  
\$49.00

### MOTOROLA

HT300 7.2v 1600 mah  
HT90 12v 600 mah  
HT440 12v 600 mah  
MT500 15v 500 mah

\$45.00  
\$34.00  
\$39.00  
\$39.00

### RADIUS

P-10 500 mah

\$28.00

### SABER

7.2v 1100 mah

\$59.00

### WINTER SPECIALS

10% Off All\*  
Cellular and  
Camcorder Battery Packs

### NEW

#### ALINCO

16N 7.2V 750 mah \$35.00  
18N 12V 600 mah \$45.00

#### YAESU

FNB 25 7.2V 600 mah  
FNB 26 7.2V 1000 mah  
FNB 26A 9.6V 800 mah  
FNB 27 12V 600 mah  
FNB 27S 12V 800 mah

### YAESU

FNB-2 v 500 mah  
FNB-2 v 600 mah  
FNB-4A 12V 1000 mah  
FNB-17 7.2V 600 mah  
FNB-10S 7.2v 1000 mah

\$55.00  
\$30.00  
\$42.00

FNB-12S 12v 600 mah  
290 charger  
(For FNB 17,10S, 12S)

\$45.00  
\$65.00

### Now Available: ALINCO 580

EBP-20N 7.2V 800 mah  
EBP-20NX 7.2V 1200 mah  
EBP-22N 12V 800 mah  
EDC-34 RAPID CHARGER \$81.00

### INSERTS

#### CALL FOR LOWEST PRICES

ALINCO 10N, 12N  
AZDEN 3000, 4000  
ICOM BP-2, 3, 5, 7, 8, 7S, 8S  
KENWOOD PB-21, 21H, 25, 26  
REGENCY MT1000, HX1200  
SANTEC 142, 144  
STANDARD BP-1  
TEMPO S-1, 2, 4, 5, BP-15, S-15  
TEN TEC 2991, 2591  
UNIDEN (BEARCAT)

### CELLULAR

MITSUBISHI \$50.00

NEC \$45.00

NOVATEL \$45.00

PANASONIC \$45.00

Bag Phone Kits

MOTOROLA \$60.00

"FLIP" \$60.00

### CAMCORDER

#### JVC

PVB80/88 12v 2.3 amps\* \$36.00

#### RCA/HITACHI

Full size

VHS-C

#### SONY

NP22

NP55/77 2400 mah \$39.00

ALL BRANDS AVAILABLE

\*original Panasonic

\*ALL BATTERY PACKS—GUARANTEED TO HAVE THE ADVERTISED CAPACITY

## BATTERY-TECH, INC.

28-25 215 PLACE, BAYSIDE, N.Y. 11360 FAX 718-461-1978

800-442-4275 — N.Y.S. 718-631-4275



CIRCLE 105 ON READER SERVICE CARD

# A Portable 40 Meter Helical Dipole

by Fred Peerenboom KE8TQ

"I don't care what kind of wires you string up, as long as no permanent towers are built. And don't interfere with my television or satellite dish," my landlord said when I asked him if I could construct some antennas around the duplex we share.

I took care of 10 through 20 meters with a partially concealed mast behind the garage, topped with a five-band (no radials) vertical. But, how about 40 meters? A lot of my friends hang out there during the day on some informal nets. A full-size 40 meter dipole needs over 66 feet of horizontal space. That's 66 feet of clear space I don't have on this city lot. The verticals on the market that cover 40 meters and don't require radials will poke a hole in your wallet and end your spouse's patience with your spending habits.

In the past I have tried a lot of other restricted space antennas, but most of them failed to perform adequately. Some failed because of incorrect information, but the main reason hinged on all the aluminum siding on the duplex. After giving it much thought, I finally decided to construct a helical dipole. Short (only 1/10-wavelength long), light, and quite portable, as well as relatively inexpensive, it embodied the features I was looking for.

## Construction

The heart of the antenna is a pair of low cost metal Slinky® toys available from most toy stores. The coil, when stretched out to 15 feet, just happens to be electrically equivalent to a half-wave 40 meter dipole. Take two of them, stretch each one out about 7-1/2 feet, feed them in the center with 50-ohm coaxial cable and, "Voilà!" you have a half-wave helical dipole for 40 meters.

Supporting the coils without putting up permanent masts was equally simple. Common PVC pipe turned out to be just the ticket. It's lightweight, easy to work with, and readily available in hardware and do-it-yourself stores. There is an added bonus to using PVC: The fittings available for the pipe make assembly and disassembly of the antenna quick and easy.

The PVC pipe comes in 10-foot sections so you will need a hacksaw or other fine-toothed saw to cut it. I also find it a good idea to use a medium file or piece of sandpaper to deburr the pipe after cutting it to make assembly easier. The only other necessary tools can be found around the house or garage. You can glue a few of the sections together (see Figure 1 for details), so get a good-grade cleaner and glue at the store when you get the PVC pipe.

Start by cutting two 8-foot-long pieces of pipe for the horizontal supports. De-burr the ends and glue a 90-degree elbow to the outer end of each section. The elbows will be

where the vertical support masts, also constructed of PVC pipe, will connect. Make sure you do not have any burrs on the two 8-foot sections; the coils must slide freely on them without catching, since this is how you tune the antenna.

The center connector is made from a "Tee" fitting. On my antenna I cut a 7-inch piece of scrap PVC pipe and glued it into the lower fitting of the Tee. I then strapped my 1:1 balun to it with plastic wire ties. The balun makes a convenient way to anchor the popular toy's coils at the center, and it keeps the TVI down to a minimum.

Slip a coil over each side of the horizontal supports and push the inner ends of the pipes into the center connector, but don't glue them. This will be the disassembly point when you take the antenna down! Now strap your balun to the center connector and, using two 1/4" electrician's split bolts, connect the inner ends of the coils to the balun's antenna connecting points. You will need the split bolts as you cannot solder to the coils. The split bolts have proven to be trouble-free connections in my system. Tie lengths of light nylon cord to the outer ends of

the coils. These will be your "tuning devices" when the antenna is up in the air, so make sure they are long enough to be reached from the ground. Now, push an upright leg into each of the 90-degree elbows at the outer ends of the cross pieces, but don't glue them! If you are not using a balun, just anchor the two coils about three inches apart in the center of the horizontal assembly with a couple of 1/4" bolts through the support pipes that have been joined with a standard coupling.

You can make the upright masts any length that is appropriate for

your location. Here at my QTH I have a second-story deck that is 10 feet above ground, so I made my two support legs 15 feet long. The antenna height of about 25 feet gives me the fairly high angle of radiation which I need for the short-to-medium-range coverage that I desire. Your best bet is to tailor the antenna height to your needs. The higher you put your antenna, the lower your skip angle will be, and the longer your transmitting range. The important thing to remember is: If it works, use it. Just try to keep the antenna as far away from any large

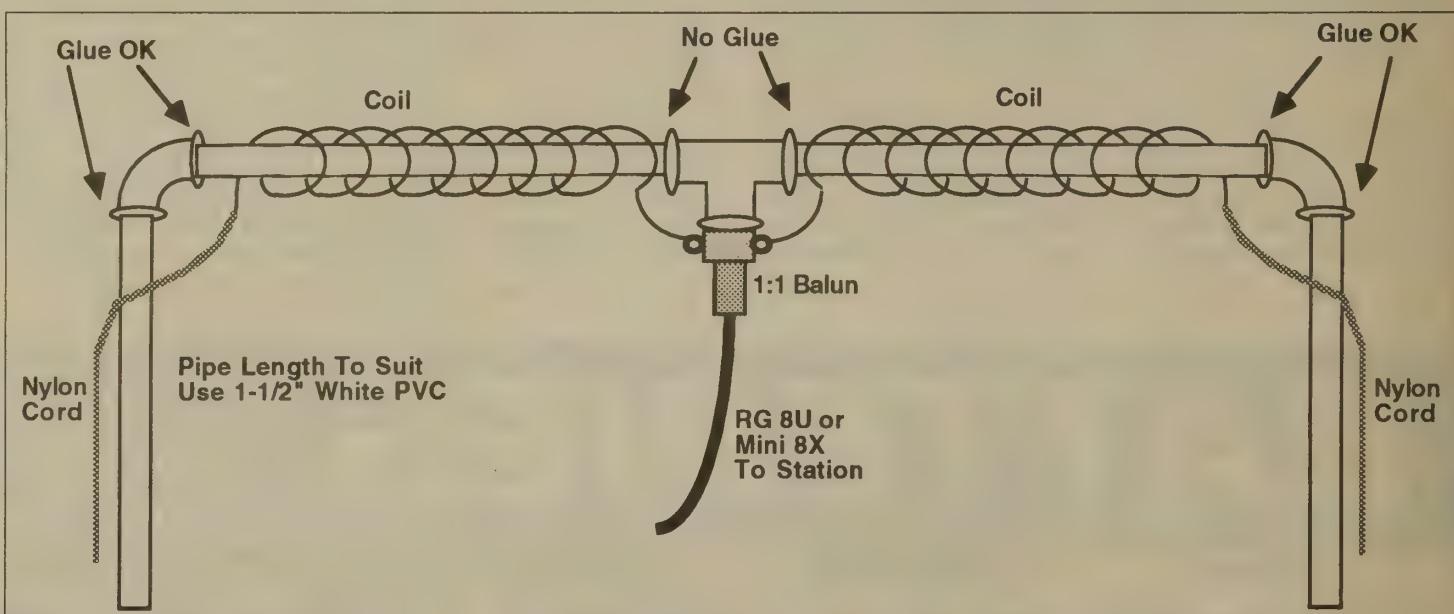


Figure 1. Complete 40 meter helical dipole.

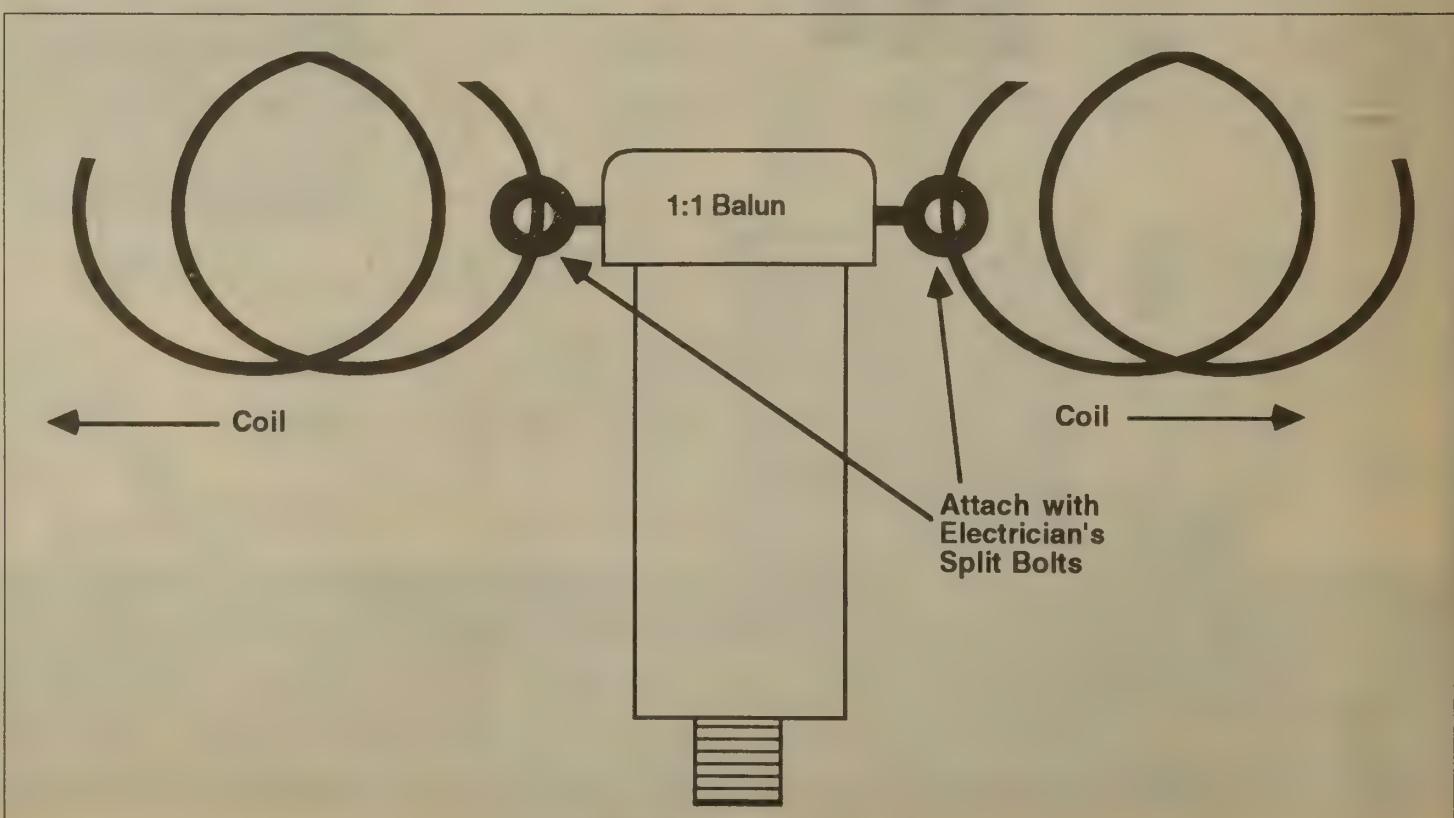


Figure 2. Balun details.

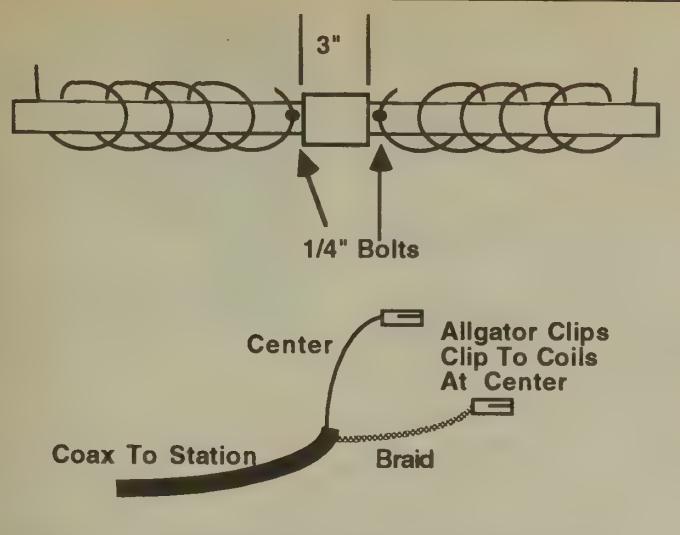


Figure 3. Central section of the non-balun version.

mass of metal, such as aluminum siding, as you can.

#### Raising the Antenna

Before you raise the assembly you will want to drill a 1/4" hole through each vertical support leg near the top for the nylon tuning cords to pass through.

If you have one, you can set the approximate length of the coils with a noise bridge. Connect the noise bridge directly to the input of the balun with a double male adapter. If you are not using a balun, make up a 6"-long jumper out of RG-58/U cable, with alligator clips on one end and a PL-259 connector on the other, to connect to the coils. Next, attach the noise bridge receiver port to your receiver with a length of coax and set the bridge controls to 50 ohms resistive and 0 ohms reactive. Tune

your receiver to your working frequency and adjust the length of both coils equally to get a deep null in the noise on the receiver. When you find that point, mark the horizontal support port with electrical tape for future reference.

If you do not have a noise bridge, stretch each coil out 7-1/2 feet and mark those spots for your starting points.

Now, connect the feedline from your rig and you are ready to raise the assembly up in the air. If you are not using a balun at the antenna feedpoint, the best way to connect the feedline will be with alligator clips soldered to the center conductor and outer shield of your coaxial cable. Then just clip the center conductor to one coil and the shield to the other.

I usually get help to steady the assembly while I strap the support legs

to the deck rail with strong cords. I haven't had the antenna blow over yet, but if you live in a windy area, you may want to add a few guys of nylon line to steady the unit.

It's now time for the smoke test. Apply just enough RF power from your rig to the antenna to get a reading on your SWR meter. Use the nylon cords that you tied to the coils and ran through the holes in the vertical legs to shorten or lengthen the coils to fine tune the antenna, being certain that you keep both coils the same length.

Because of the short physical length of this antenna, you will find the band width to be quite narrow; also, the location of your antenna and the height above the ground have a major effect on its tuning. Because of this I tuned the antenna across a series of frequencies 50 kHz apart and marked each point with colored electrical tape on the bottom of the horizontal support pipes where I can see it when the antenna is up in the air. Now when I make any major change in frequency, I can quickly adjust the coils to the proper mark for tuning.

Although I don't have a full-size 40 meter dipole to compare my helical version to, its performance speaks for itself. It does the job I want with only 100 watts output from my transmitter, the balun at the feedpoint keeps the TVI down, and the landlord is happy because it isn't permanent. What more could a ham ask for except, possibly, a new "Super Bells And Whistles 9000" rig to go with it?

Since I've constructed the 40 meter antenna, my thoughts have strayed to making an 80 meter version. All I'd need are a few more of the kid's toys and some more PVC pipe. The possibilities are endless. **RF**

## The Theodore Roosevelt Amateur Radio Club



Photo A. The Hope Christian Academy amateur radio class.

We need to get more kids involved with amateur radio. With that inspiration, Steve Allar NØELA of Beulah, North Dakota, sent us photos and a description of what they are doing in that part of North Dakota.

Their club is called the Theodore Roosevelt Amateur Radio Club, based in Dickinson, North Dakota. At one club meeting, the Kenwood Kids Program was brought up. They all thought this was a very good idea so one member, Doug Roise AAØCV, approached the Hope Christian Academy in Dickinson about starting a class. The school was receptive, and a class was formed. The class consists of grades 4 through 6. The kids' are from 10 to 12 years old. Their teacher is Karen Landblom. There are 12 students.

Doug AAØCV teaches the kids about amateur radio with the *Now You're Talking* books. He is assisted by his sons, Peter NØLZO and Andrew NØLZN. He comes to the classroom for 45 minutes each day,



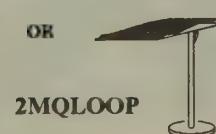
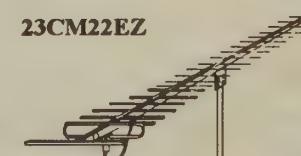
Photo B. Doug Roise AAØCV teaching his class.

Monday through Friday. At the session shown in the photos, Doug was teaching the students "Rules and Regulations," and also conducting some CW practice.

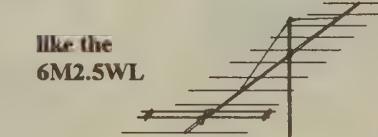
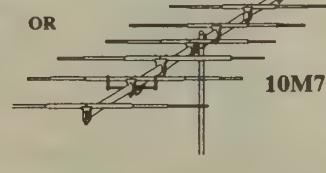
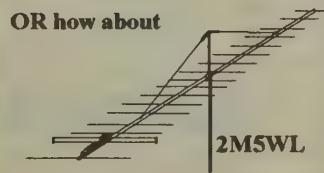
The kids seem to be enjoying themselves and learning, too. The club hopes to turn out a dozen new hams at the conclusion of the class (they have a tentative testing date of March 21). The club wishes them all success, and would like to thank the Kenwood Corporation for their Kenwood Kids Program. **RF**

# M2 Has Antennas for the future

**SURE M2 Has a lot of innovative NEW ANTENNAS!!**



**BUT DON'T FORGET THE GREAT ONES THAT STILL BREATH FIRE ON THE BANDS!**



*And remember we can help with the phasing harnesses, power dividers, H frames and of course AZ and EL rotators!*

**436CP3**

**M2 Enterprises 7560 N. Del Mar Fresno, CA 93711 (209) 432-8873 FAX (209) 432-3059**

CIRCLE 274 ON READER SERVICE CARD



# radio magic

by Michael Bryce WB8VGE

Since there are only so many ways to produce an RF signal, many companies started to add increasingly more operating features to their equipment. The so-called "radio of the month" is nothing more than a manufacturer's basic rig—but with a new knob controlling a new feature.

However, in the past year or so, there seems to be a new buzzword flying about. It's called Digital Signal Processing, or DSP. One could very easily fill an entire issue of *Radio Fun* describing Digital Signal Processing. Let me try to reduce the overhead to some very simple terms.

## Digital Signal Processing

Digital Signal Processing is a very new kid on the block. A special function microprocessor is the brain behind Digital Signal Pro-

cessing. A common Digital Signal Processor or CPU is the TMS320C10. The TMS320C10 operates at 20 MHz and is capable of processing of five million instructions per second (MIPS). The TMS320C10 has two separate memories: one for the program and the other for signal data. The programs (usually two or three) are held in an external PROM or Programmable Read-Only Memory. Someone writes the proper code (it's called software) and when the software is burned into a PROM it is now known as firmware) and then burns a PROM with a computer with the proper interface. By changing the firmware by way of the PROM you can change the function of the DSP processor.

Most of the DSP circuits today deal with audio filters. In particular, the application of DSP works best on multiple automatic notch

filters and nonlinear CW filters. Automatic SSB fine-tuning as well as audio processing for RTTY/AMTOR and HF packet is also within DSP programming.

In the past, if you wanted to eliminate a tuner-upper or other CW QRM, you did so with an analog circuit. You could use op amps, LC networks, RC networks and other audio cut-off circuits. With DSP, the use of a microprocessor gives an almost perfect bandpass filter frequency response. That's something really hard to do using even the best op amps and high quality components with an analog circuit. But the real beauty of DSP is the ability to change the frequency cut-off or bandpass frequency response by simply changing the firmware. To change the cut-off frequency of an analog audio filter requires changing out individual components.

Here's an example to show how DSP and an analog circuit compare. Let's say we're on 40 meter SSB. It's getting late and the broadcast stations are coming on. If you're in a QSO with someone and HCJB comes online, the heterodyne from the two signals will make for difficult copy. Most of the rigs produced today have an audio notch filter built in. Some of these filters have very steep skirts and have a notch depth of between 40 and 60 dB down. Careful tuning of the notch control will eliminate (or greatly reduce) the interference, allowing you to continue with the QSO. Now, provided neither one of you moves, HCJB will stay in the notch filter and all will be right with the world. But, what happens if you change frequency—even just a few cycles? Well, the notch control will have to be re-adjusted to reject the heterodyne again. What happens if a second (or third) broadcast station comes up? Our notch control can only do one signal at a time! So more than likely it's QRT for the evening without a DSP audio processor inside your rig.

But what makes me madder than Jim Bowie with a dull knife is the "shoisher." A shoisher is someone sweeping a transmitted carrier band back and forth across the passband of your receiver. They are almost impossible for an analog notch filter to eliminate. It's impossible to manually track such

a carrier with a hand-tuned audio or IF notch filter. They're too fast to catch and keep tuned. A DSP automatic notch filter can easily handle the shoisher and make life easier on 40 meters. Depending on the firmware and the DSP unit, some are able to handle several shoishers and carriers at the same time.

So, if all of this DSP stuff is so great, why have we seen so little of it? Well, price is one reason; another is that it's new. New things scare people. High-speed CPU chips are being made cheaper all the time. The cost of digital signal processing has dropped to the point where it is competitive with analog techniques.

There are some drawbacks to DSP, too. For one thing, a CPU running at 20 MHz generates all kinds of EMI (Electrical Magnetic Interference). Keeping EMI out of a very sensitive front end of a radio is quite an engineering task. It's bad enough to have phase noise on top of a signal you're trying to copy, let alone adding extra signals from the circuit trying to pull the station out!

Should your new radio have DSP? Yes! The future is here. Like the built-in antenna tuners, built-in DSP will give you a lot of performance for the money. It's also cheaper to buy a rig with DSP already inside than to add it later.

Continued on page 27

## "Our products speak... for themselves"

### DIGITAL VOICE RECORDER

**AudioQ218**

✓ UP TO 218 SECONDS RECORD TIME  
✓ UP TO 8 MESSAGES  
✓ 4 SAMPLE RATES  
✓ SPEAKER OUTPUT  
✓ LO LEVEL OUTPUT  
✓ 4 MEG OF RAM  
✓ LO POWER  
✓ TX ENABLE 400ma  
✓ BATTERY BACKUP  
✓ 8-15v DC OPERATION  
✓ SMALL SIZE 2.5" X 2.5"

### REPEATER CONTROLLER

VOICE ID'er--KE2AM VER B  
SEE REVIEW OF VERSION A  
JUNE 1991 ISSUE OF 73 MAG.

✓ DIGITAL VOICE ID  
✓ BATTERY BACKUP  
✓ TIME-OUT TIMER  
✓ TX HANG TIMER  
✓ AUDIO MIXING  
✓ ID TIMER  
✓ MUTING  
✓ TX ENABLE 400ma  
✓ COR OR SQUELCH KEYED  
✓ 8-15v DC OPERATION  
✓ SMALL SIZE 3.2" X 3.4"

\$149.00  
PLUS S+H

NOT A KIT  
\$119.00  
PLUS S+H

Both units are fully assembled and tested.  
Full documentation is included.  
For more information, call or write.

SPECIFICATIONS AND PRICES SUBJECT TO CHANGE.

GET-TECH  
201 RILEY ROAD  
NEW WINDSOR, NY 12553  
(914)564-5347

## Are You Fed Up Yet?

Fed up with political waffling? The deficit? Crime? Drugs? Our crooked Congress? Welfare? Our rotten education system? It's time for creative solutions to New Hampshire's recession and the mess in Washington D.C. What can we do?

We can ...

## Declare War!

### On Our Lousy Government A GUERRILLA HANDBOOK "...Must reading"

New Hampshire entrepreneur Wayne Green — pioneer of a high-tech magazine empire, computer industry legend, champion of the independent music recording movement, and most recently an active member of the Economic Development Commission — is sick of hearing about our problems. Sick of it. What about solutions?

In his new 380-page book, *Declare War*, Wayne Green spells out in detail how to approach our problems ... and solve them logically, without raising taxes.

*Declare War* is must reading for anyone who understands that America is going nowhere. You might not agree with all of his proposals, but he brings to the table a clear headed way to approach our problems with logic, compassion, and facts — instead of baloney.

His entertaining and insightful message reminds us that solutions are available if we take the high road and forget our political baggage. Love his ideas or hate them, Wayne Green offers us a unique way to find solutions. Order your copy of *Declare War* at your local bookstore, or call 800-234-8458. \$14.95 (add \$2 for shipping and handling.) DVRF9302

## SATELLITE T.V.

Factory Direct to Your Door

Echostar • Startrak • Houston Tracker • Orbitron

- Call for FREE Huge Color Catalog
- Domestic & International Systems
- Huge Savings!

Info & Orders

**ECHOTRAK™** 305-344-6000

4749 NW 98th Lane • Coral Springs, FL 33076

CIRCLE 157 ON READER SERVICE CARD

## WEFAX To The Max



### PC GOES/WEFAX 3.0 \$250

PC GOES/WEFAX 3.0 is a professional fax reception system for the IBM PC. It includes an AM/FM demodulator, software, cassette tutorial and 325 page manual. Check this partial list of our advanced features:

Res. up to 1280x800x256 APT Lat/Lon. Grids  
Unattended Operation Orbital Prediction  
Colorization Frame Looping  
Zoom, Pan, Rotation PCX & GIF Export  
Contrast Control Grayscale Printing  
Tuning Oscilloscope Infrared Analysis  
Photometry/Histograms Variable IOC & LPM

### PC HF FAXSIMILE 6.0 \$99

PC HF Facsimile 6.0 is a complete shortwave FSK fax system for the IBM PC. It includes an FSK Demodulator, software, 250 page manual and tutorial cassette. Call or write for a complete catalog of products.

### Software Systems Consulting

615 S. El Camino Real, San Clemente, CA 92672  
Tel: (714) 498-5784 Fax: (714) 498-0568

CIRCLE 250 ON READER SERVICE CARD

## SUPER QRP TRANSMITTER! It's so easy — It's ready to go!



Completely built and tested, extremely high quality.  
• Complete low power CW transmitter  
• Up to 2-1/2 watts RF output  
• Excellent keying characteristics  
• 10-16 VDC operation  
• Compact, rugged and easy to operate  
• Superior QRP world-wide, military grade

Just connect a battery, antenna, key and plug in your favorite crystal—That's it!—**BEST GLOBAL VALUE**

SW1-15M \$23.95 SW1-40M \$24.95  
SW1-17M \$23.95 SW1-80/75 \$26.95  
SW1-20M \$23.95 SW1-160M \$34.95  
SW1-30M \$23.95 Metal Case \$8.95  
Xtals: 21160, 21150, 21060, 18074, 14060, 10115, 10106, 7125, 7110, 7040, 7030, 3700, 3550, 3535 \$5.95 ea  
To order: Specify meter band desired and include check or money order for correct amount. Also include \$2.50 (U.S. Can. & Mex.) \$8 all other for first class shipping. PA residents add 6% sales tax to price of unit(s). Foreign orders must send money order drawn on U.S. correspondent bank only

**RYAN COMMUNICATIONS**

Box 111E Camelot Rd., Portersville, PA 16051, USA  
Phone: (412) 368-3859

CIRCLE 32 ON READER SERVICE CARD

## THE FAMED 2 METER A. S. A. 9209

+9 db Co-Linear "MultiWave" Base Station Double 5/8 over 1/4 wave delivers up to +9 db gain. All fiberglass & solid aluminum construction. Fits masts up to 1-1/2". 2 Meter Base Station 10' length.

**\$32.43**

+\$4.00 S&H  
(SC RES. 5% SALES TAX)  
CHECK IN ADVANCE OR C.O.D.  
ALSO AVAILABLE IN 220 & 440

ASA

Model 9209  
+9db

CIRCLE 18 ON READER SERVICE CARD

## SRC-10 REPEATER/LINK CONTROLLER



DTMF muting  
Intelligent ID'er  
Auxiliary outputs  
Easy to interface  
Alarm monitor input  
Telemetry response tones  
Low power CMOS, 22ma @ 12v  
Detailed application manual  
Programmable COS polarities  
Repeater & link courtesy tones  
Synthesized link/remote base capability

**\$149.00** Assembled & Tested

**CREATIVE CONTROL PRODUCTS**  
3185 Bunting Avenue  
Grand Junction, CO 81504  
(303) 434-9405

CIRCLE 146 ON READER SERVICE CARD

# the tech side

by Michael Jay Geier KB1UM

## The End of Amps

Let's finish up our discussion of amplifiers. Last time, I mentioned that an amplifier's current could be pulled through a transformer instead of a resistor. Why do that?

## Waste Not, Want Not

We saw that it is necessary to have a ratio of resistances to accomplish voltage amplification; that's how we convert current changes into voltage changes. Once our signal has enough voltage, though, we need to current-amplify it if we want to drive much of a load with it. Certainly, it is possible to use a resistor for that, too, but it sure is wasteful. Much of the amplifier's power winds up getting converted to heat in the resistor instead of being delivered to the speaker, antenna or whatever. Is there any way to increase the efficiency of the circuit?

There sure is! What if we pull the amplifier's current *directly* through the load? Let's try it. Let's put a speaker in place of the resistor feeding the gain element. What happens? Hey, it works... sort of. You can hear something coming from the speaker, but it ain't very loud. And the speaker cone is pushed way out. And wait a minute, the transistor pulling the current through it is getting awfully hot. Isn't there supposed to be *less* heat this way?

## Matchmaker, Matchmaker

Let's take a look at why this doesn't work too well. Yes, we are pulling all the current through the speaker. However, that speaker has only eight ohms of resistance! That means that the transistor doing the pulling has to pull very hard. In other words, the speaker isn't limiting the current flow very much, so the transistor gets mighty hot because too much current is flowing. Also, with such low resistance, the ratio of the two resistances (the speaker's and the transistor's) is reversed from the optimum; the transistor's should be able to go both lower and higher, in order to pull the current through the speaker both high and low, moving the cone a significant amount. Here, the transistor's resistance is mostly above that of the speaker, so not much moves. It's almost as if the speaker were a dead short compared to the hundreds of ohms present in the transistor. Essentially, the low-impedance speaker is a *poor match* to the transistor. By the way, the rea-

son the cone is distended is because DC power is flowing through the speaker's coil, causing it to keep the cone pushed out. (Remember, a speaker is just an electromagnet wrapped around a permanent magnet.) If you reverse the speaker leads, the speaker will stay pulled in. What we really want to send to the speaker is a changing current representing an amplified version of the input signal, right? Well, there's an easy way to do that which also cures the mismatch problem. Let's use a transformer.

## Iron It Out

A transformer is nothing more than two coils of wire wrapped around an iron core. Its name is particularly apt because it really does transform, or change, the ratio of current to voltage from its input to its output. How? Current flowing through the first coil creates a magnetic field around the iron core, just as would any electromagnet. As that field cuts through the windings of the second coil, it generates a current in that coil. So where's the magic?

The trick is that the two coils don't have to be the same length! When the power is in the form of magnetism, it is "classless." That is, it consists of a single quantity: magnetism of a certain strength. It has no specific voltage or current equivalent; only the total power (current times voltage) is important. If we wind lots of wire on the first coil, it will have enough resistance to match the amplifier's transistor. If we then wind fewer turns of wire on the second coil, its resistance will be optimum for the speaker. So, the higher-voltage, lower-current power applied to the first coil will be transformed into a lower-voltage, higher-current power source in the second coil, which is just what we need to drive an 8-ohm speaker. Of course, the total power will not be increased, just the form in which it is delivered. In other words, if we double the current, we halve the voltage; the number of watts stays the same. If that weren't true, we could use transformers as amplifiers themselves! Oh, well, there ain't no free lunch.

## Humanity's Salvation?

Hey, if we can generate power with a magnetic field, why not just take a bunch of permanent magnets and wrap coils around them, thus ending humanity's energy crisis once

and for all? Unfortunately, it is only the *changes* in the field which make power in the coil. In effect, the magnetism is a kind of catalyst. If you move the magnet, the changing field will create power, and that's exactly what electric generators do when they spin the coil in a magnetic field. But it takes more power to turn the generator than you get out of it (because no process is perfectly efficient; there are always losses), so there goes perpetual motion. In fact, the lower the resistance of the load you connect to the coil, and thus the more current you are drawing, the harder it becomes to turn the generator! Too bad, but we didn't get to write the laws of physics.

## The Last Trick

Oops, I promised that the transformer also would cure the problem of the speaker cone's being pushed out or pulled in all the time. Well, just as in the generator example, the constant DC power being pulled through the first coil does not get transferred to the second coil. Only the changes in it, which correspond to our signal, make power in the second coil. Obviously, the bigger those changes, the more power gets to the speaker. And, with the DC blocked, the cone moves back and forth, just as it should. By the way, the first coil is called the *primary* and the second coil is called the *secondary*. Those terms are relative, though; whichever coil you connect to the power source is the primary and the one connected to the load is the secondary.

## OTL

It is possible to match an 8-ohm speaker directly to an amplifier without using a transformer. It requires a particular type of design, though, in order to make the amplifier's resistance low enough. In this case, the DC power is not pulled directly through the speaker. Instead, the speaker is connected across (in parallel with) the amplifier at its output point. Such a design is called OTL, or Output TransformerLess. Most of today's stereo amplifiers work that way, because transformers have certain characteristics which interfere with pure sound reproduction. Also, the transformers are heavy and expensive.

## RF

Getting power to an antenna is

much the same. Obviously, you can't pull power through an antenna because there is no DC path. But, you can apply it either through a transformer or directly from an amplifier which is designed to match it. Most commercial HF rigs take the transformer approach. Luckily, transformers designed for such high frequencies can be much smaller and lighter than those used for audio. Most VHF radios, however, do not use transformers because it is tricky to design a transformer with low losses at those frequencies. They use an OTL approach similar to the one used for stereo amps.

## Try It

The specifics of designing various kinds of amplifiers are beyond what we can cover here. If you want to learn more, though, get some parts and try making some small audio amps. The best place to start is with an LM-386 chip. This 8-pin IC can be had for next to nothing at Radio Shack. It is an OTL design which couples the speaker with a capacitor to block the DC. Get one and fool with it; you'll have lots of fun. And, when you're done, you will have a nice little amp you can use in all kinds of receiver projects. Also, if you get some project magazines or booklets, you will probably find the diagrams for some simple non-IC amplifiers. Those will give you a better insight into the workings of real, practical amplifier circuits.

Now, let's look at a letter:

### Dear Tech Side,

I have two batteries for my 2 meter HT. One is for 3 watts and the other is for 5 watts and is much bigger. But they last about the same time before needing to be recharged. couldn't the bigger one last longer?

Signed,  
Bigger is Better?

### Dear Bigger,

The wattage ratings you are describing refer to how much power the battery will make the radio put out when you are transmitting. The 5-watt battery has a higher voltage than the 3-watt one, and that makes the transmitter work harder and put out more power. But, it's the amount of current, not voltage, stored in each battery that determines how long it will last. If your radio draws, say, 500 millamps, a 500-millamp-hour battery will last one

hour, and a 1,000-millamp-hour battery will last two hours, regardless of its voltage, and regardless of how much power your transmitter is producing. In fact, most radios draw more current when putting out higher power, so they consume the higher-voltage batteries even faster.

Well, folks, that about does it for this month and our discussion of amplifiers. Next month, something new! 73 until then from KB1UM. **RF**



**SAVE MONEY-  
HIGH QUALITY,  
FAST DELIVERY**

General Communication  
Industry  
Marine VHF • Scanners  
Amateur Bands  
Microprocessor

**CALL TOLL FREE:  
1-800-JAN-XTAL**

**JAN Crystals**

P.O. BOX 06017 • Fort Myers, Florida 33906

(813) 936-2397



CIRCLE 240 ON READER SERVICE CARD

*Joe Carr*  
K4IPV

# antennas, etc.

by Joseph J. Carr K4IPV

## Antenna Patterns and Reciprocity

Standard wisdom tells us that the dipole antenna has a "figure-eight" radiation pattern. Right? Yes, but it's also wrong. We tend to see antenna patterns from one viewpoint only, and that is usually from the plain-view perspective. That is, the antenna pattern considered is the azimuthal pattern. On the dipole, the figure-eight pattern is the azimuthal pattern. But the azimuthal pattern is not the full extent of it, for antenna patterns are three-dimensional.

Standard wisdom also tells us that a vertical antenna "radiates equally well in all directions." Sure, in the horizontal or azimuthal extent, but in the vertical extent there is a distinct directivity in the antenna's radiation pattern.

Figure 1 shows the pattern for a vertical radiator in free space. This figure is adopted from a U.S. Army Korean War vintage radio training manual, which seems to do a better job of describing the situation than many modern ham publications. In the lower left is the three-dimensional pattern, which resembles a "doughnut" or "torous" shape. It has a depression in the center above the radiator, which represents the null region in the vertical direction. This figure shows two sectioned views: one taken horizontally through the torous; the other taken vertically.

Antenna patterns for each section are also graphed. The horizontal or azimuthal pattern is the omnidirectional pattern normally considered for vertical radiators. The vertical pattern, or elevation extent, shows a variation in the pattern, with a lobe

in each direction and a null straight up.

Real antennas will vary somewhat from the patterns shown here for a variety of reasons. When a vertical is placed near the ground, only the top half of the vertical extent pattern is available. Also, when the antenna is other than  $\lambda/4$ , the maxima on the vertical pattern will be different than for the  $\lambda/4$  case. The angle of radiation, which is the angle that the maxima makes with the earth's surface, or at least a line tangent to the earth's surface, seriously affects where in the universe the signal goes.

We can get a partial, but reasonably complete, view of the antenna pattern by considering the azimuthal pattern and at least one elevation cut. It is not generally necessary in amateur radio circles to graph the entire pattern. However, in professional engineering circles it is usually necessary to take a look at a number of different cuts.

## Antenna Reciprocity

The Law of Reciprocity (apart from its New Age connotations) concerning antennas is real simple: Antennas operate the same in both receive and transmit modes. In other words, the pattern for the antenna in receive is identical to the pattern on transmit. This law is one of the Articles of Religion amongst antenna gurus. Every time someone claims to have invented a nonreciprocal antenna a flaw is found in either their measurements or logic. Reciprocity still reigns.

From time to time, a different attack on antenna reciprocity is seen. The argument is made that

ionospheric communications, which is the means by which "skip" communication occurs in the HF region, alters the pattern. A well-known phenomenon is the bending of electromagnetic wave propagation direction when in the presence of an ionized medium and a magnetic field. These conditions are found in the earth's atmosphere. A supposedly corroborating argu-

ment is the well-known phenomenon seen on the East Coast of the U.S.A. On some afternoons, especially on 40 meters, we can hear European amateur stations but can't work them. Obviously, say the critics, the antenna is nonreciprocal . . . it works differently on transmit than receive, otherwise the Europeans would answer us. Apart from the possibility that the Eurohams might be ignoring us (not really, but there are a lot of W/K/N hams), that argument seems reasonable. However, it falls of its own weight. The system of antenna plus propagation medium is nonreciprocal but the antenna is not. If that same antenna were scaled up to VHF, where the phenomenon does not occur, or tested at the same 40 meter frequency in a huge anechoic (without any echo) chamber antenna range, reciproci-

ty would be seen to hold true. The fact that the medium is nonlinear in no way implies nonreciprocity of the antenna.

## Your Inputs Solicited . . .

We've been running this column for a few months now, and I would like to hear from readers. Complaints and criticism are always welcome (unless you wrap them in a brickbat), but more importantly I want to know the topics that would interest you. Write to me at P.O. Box 1099, Falls Church VA 22041. Please don't call, though. My schedule is tight, and I rarely have time to rag-chew on the landline. Recently, a couple of fellows have called me and gotten real rude when I told them I could not talk to them at the time. RF

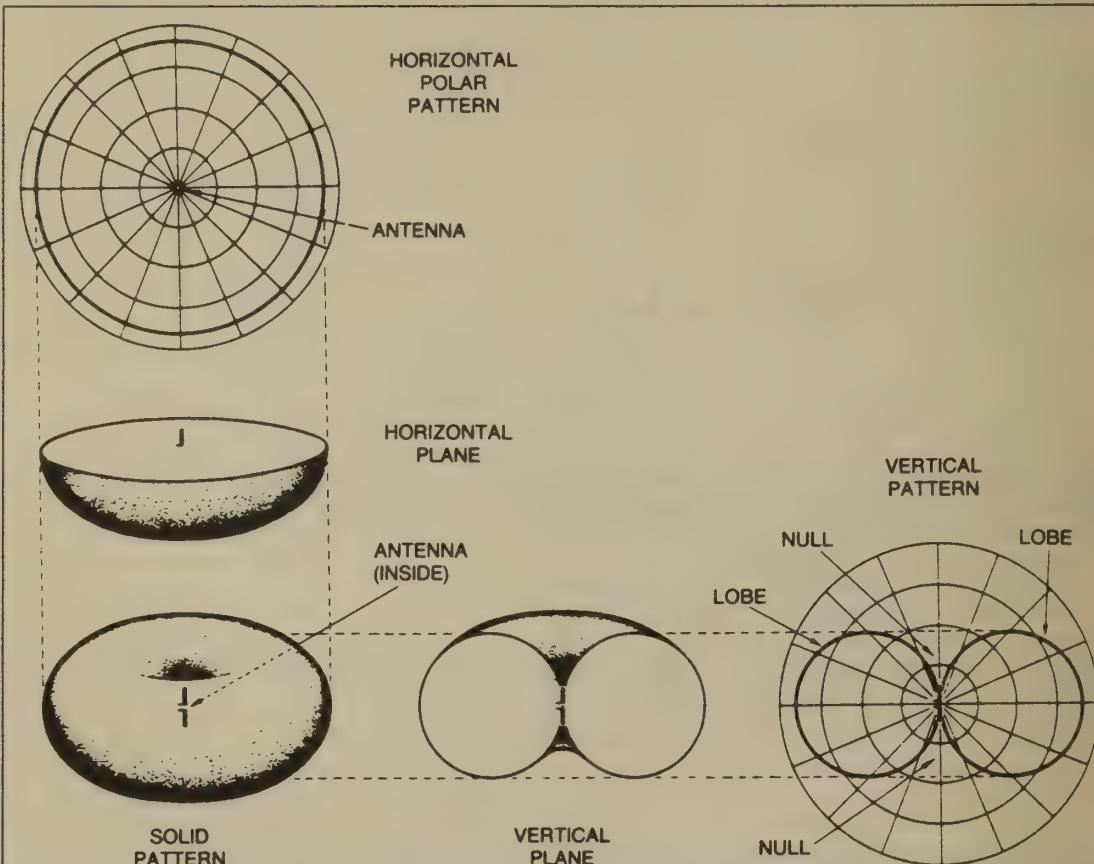


Figure 1. All-dimensional radiation pattern for a typical  $\lambda/2$  vertical radiator in free space.

# HELPING HAMS GET ON THE AIR!

SINCE 193

## INFORMATIVE STARTER KIT INCLUDES:

- Novice and Tech Written Element Study Guide
- Practice Key and Oscillator
- Code Practice Cassette Tapes
- Theory Tapes
- FCC Rule Book
- Valuable Coupons Good Toward the Purchase of Ham Radio Equipment

PACKAGE PRICE - \$59.95

WHETHER YOU'RE AN "O.M." OR JUST A "NOVICE,"  
QUEMENT IS SURE TO MEET ALL YOUR NEEDS!

**QUEMENT**  
ELECTRONICS

PHONE (408) 998-5900

1000 S. BASCOM AVENUE • SAN JOSE, CA 95128

CIRCLE 132 ON READER SERVICE CARD

FEATURING LINES BY:

**ICOM**

**YAESU U.S.A.**

**ALINCO**

AND THOUSANDS OF  
ACCESSORIES!

# DON'T MISS OUT! SUBSCRIBE TO *Radio Fun* FOR ONLY \$12.97!

## 12 GREAT ISSUES!

CONTACT YOUR  
ADVERTISERS  
EASILY!

FILL OUT THIS  
**FREE**  
READER SERVICE CARD  
AND SEND IT TODAY!

NO OTHER  
MAGAZINE BRINGS  
YOU THE EXCITING  
WORLD OF  
AMATEUR RADIO  
LIKE

**73 Amateur  
Radio Today**

**2 ISSUES ONLY \$19.97!**

ribe Now! 12 issues for \$12.97.

io Fun for the low price of \$12.97.

\$. (In New Hampshire, call 603-924-0058).

print)

Call

Zip

ment enclosed

date

QST Subscriber  CQ Subscriber

\$24. Basic subscription rate \$14.97. 05R

## ER SERVICE CARD February 1993

THIS CARD VALID UNTIL 3/31/93

7 8 9 10	201 202 203 204 205 206 207 208 209 210
7 18 19 20	211 212 213 214 215 216 217 218 219 220
7 26 29 30	221 222 223 224 225 226 227 228 229 230
7 38 39 40	231 232 233 234 235 236 237 238 239 240
7 48 49 50	241 242 243 244 245 246 247 248 249 250
7 58 59 60	251 252 253 254 255 256 257 258 259 260
7 68 69 70	261 262 263 264 265 266 267 268 269 270
7 78 79 80	271 272 273 274 275 276 277 278 279 280
7 88 89 90	281 282 283 284 285 286 287 288 289 290
7 98 99 100	291 292 293 294 295 296 297 298 299 300
7 108 109 110	301 302 303 304 305 306 307 308 309 310
7 118 119 120	311 312 313 314 315 316 317 318 319 320
7 128 129 130	321 322 323 324 325 326 327 328 329 330
7 138 139 140	331 332 333 334 335 336 337 338 339 340
7 148 149 150	341 342 343 344 345 346 347 348 349 350
7 158 159 160	351 352 353 354 355 356 357 358 359 360
7 168 169 170	361 362 363 364 365 366 367 368 369 370
7 178 179 180	371 372 373 374 375 376 377 378 379 380
7 188 189 190	381 382 383 384 385 386 387 388 389 390
7 198 199 200	391 392 393 394 395 396 397 398 399 400

## FORMATION

05U

ertised in this issue of Radio Fun circle  
iry. Offer valid in the U.S. and possessions only.

## h *adio Today.*

ll of 73 for the low price of \$19.97!  
price). Mail this postage paid card  
oll free: 800-289-0388 (In Colorado,

(please print)

Call

State

Zip

Bill me

Visa  Amex

Exp. date

asic subscription rate \$24.97 (Canadian orders  
1.40 GST; other foreign countries add \$19.00 per  
00 per year for airmail. Please allow 4-6 weeks

4QCD8

*Joe Carr*  
K4IPV

# antennas, etc.

by Joseph J. Carr K4IPV

## Antenna Patterns and Reciprocity

Standard wisdom tells us that the dipole antenna has a "figure-eight" radiation pattern. Right? Yes, but it's also wrong. We tend to see antenna patterns from one viewpoint only, and that is usually from the plain-view perspective. That is, the antenna pattern considered is the *azimuthal* pattern. On the dipole, the figure-eight pattern is the azimuthal pattern. But the azimuthal pattern is not the full extent of it, for antenna patterns are three-dimensional.

Standard wisdom also tells us that a vertical antenna "radiates equally well in all directions." Sure, in the horizontal or azimuthal extent, but in the vertical extent there is a distinct directivity in the antenna's radiation pattern.

Figure 1 shows the pattern for a vertical radiator in free space. This figure is adopted from a U.S. Army Korean War vintage radio training manual, which seems to do a better job of describing the situation than many modern ham publications. In the lower left is the three-dimensional pattern, which resembles a "doughnut" or "torous" shape. It has a depression in the center above the radiator, which represents the null region in the vertical direction. This figure shows two sectioned views: one taken horizontally through the torous; the other taken vertically.

Antenna patterns for each section are also graphed. The horizontal or azimuthal pattern is the omnidirectional pattern normally considered for vertical radiators. The vertical pattern, or elevation extent, shows a variation in the pattern, with a lobe

in each direction and a null straight up.

Real antennas will vary somewhat from the patterns shown here for a variety of reasons. When a vertical is placed near the ground, only the top half of the vertical extent pattern is available. Also, when the antenna is other than  $\lambda/4$ , the maxima on the vertical pattern will be different than for the  $\lambda/4$  case. The angle of radiation, which is the angle that the maxima makes with the earth's surface, or at least a line tangent to the earth's surface, seriously affects where in the universe the signal goes.

We can get a partial, but reasonably complete, view of the antenna pattern by considering the azimuthal pattern and at least one elevation cut. It is not generally necessary in amateur radio circles to graph the entire pattern. However, in professional engineering circles it is usually necessary to take a look at a number of different cuts.

## Antenna Reciprocity

The Law of Reciprocity (apart from its New Age connotations) concerning antennas is real simple: Antennas operate the same in both receive and transmit modes. In other words, the pattern for the antenna in receive is identical to the pattern on transmit. This law is one of the Articles of Religion amongst antenna gurus. Every time someone claims to have invented a nonreciprocal antenna a flaw is found in either their measurements or logic. Reciprocity still reigns.

From time to time, a different attack on antenna reciprocity is seen. The argument is made that

ionospheric communications, which is the means by which "skip" communication occurs in the HF region, alters the pattern. A well-known phenomenon is the bending of electromagnetic wave propagation direction when in the presence of an ionized medium and a magnetic field. These conditions are found in the earth's atmosphere. A supposedly corroborating argu-

ment is the well-known phenomenon seen on the East Coast of the U.S.A. On some afternoons, especially on 40 meters, we can hear European amateur stations but can't work them. Obviously, say the critics, the antenna is nonreciprocal . . . it works differently on transmit than receive, otherwise the Europeans would answer us. Apart from the possibility that the Eurohams might be ignoring us (not really, but there are a lot of W/K/N hams), that argument seems reasonable. However, it falls of its own weight. The system of antenna plus propagation medium is nonreciprocal but the antenna is not. If that same antenna were scaled up to VHF, where the phenomenon does not occur, or tested at the same 40 meter frequency in a huge anechoic (without any echo) chamber antenna range, reciproci-

ty would be seen to hold true. The fact that the medium is nonlinear in no way implies nonreciprocity of the antenna.

## Your Inputs Solicited . . .

We've been running this column for a few months now, and I would like to hear from readers. Complaints and criticism are always welcome (unless you wrap them in a brickbat), but more importantly I want to know the topics that would interest you. Write to me at P.O. Box 1099, Falls Church VA 22041. Please don't call, though. My schedule is tight, and I rarely have time to rag-chew on the landline. Recently, a couple of fellows have called me and gotten real rude when I told them I could not talk to them at the time. **RR**

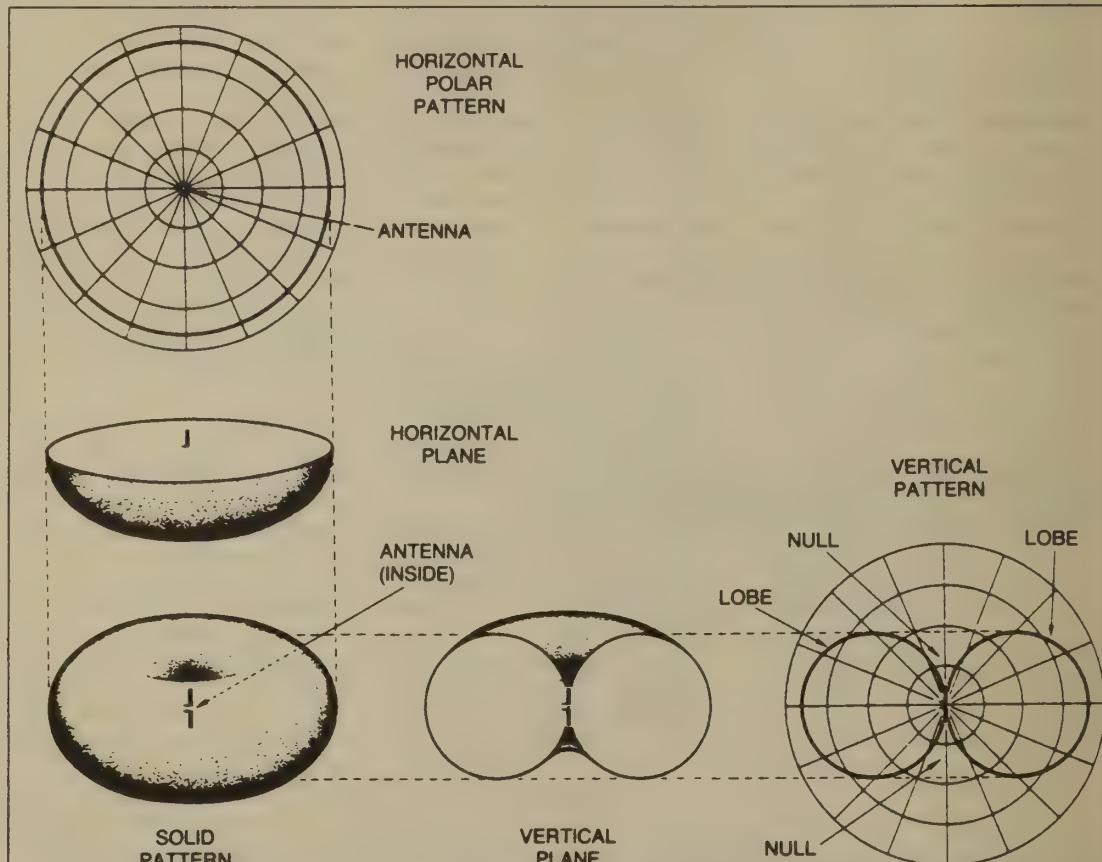


Figure 1. All-dimensional radiation pattern for a typical  $\lambda/2$  vertical radiator in free space.

# HELPING HAMS GET ON THE AIR! SINCE 193

## INFORMATIVE STARTER KIT INCLUDES:

- Novice and Tech Written Element Study Guide
- Practice Key and Oscillator
- Code Practice Cassette Tapes
- Theory Tapes
- FCC Rule Book
- Valuable Coupons Good Toward the Purchase of Ham Radio Equipment

PACKAGE PRICE - \$59.95

WHETHER YOU'RE AN "O.M." OR JUST A "NOVICE,"  
QUEMENT IS SURE TO MEET ALL YOUR NEEDS!

**QUEMENT**  
ELECTRONICS

PHONE (408) 998-5900

1000 S. BASCOM AVENUE • SAN JOSE, CA 95128

CIRCLE 132 ON READER SERVICE CARD

FEATURING LINES BY:

**ICOM**

**YAESU U.S.A.**

**ALINCO**

AND THOUSANDS OF  
ACCESSORIES!

**DON'T MISS OUT!**  
**SUBSCRIBE TO**  
***Radio Fun***

**FOR ONLY \$12.97!**

**2 GREAT ISSUES!**

---

**CONTACT YOUR  
ADVERTISERS  
EASILY!**

**FILL OUT THIS  
FREE  
READER SERVICE CARD  
AND SEND IT TODAY!**

---

**NO OTHER  
MAGAZINE BRINGS  
YOU THE EXCITING  
WORLD OF  
AMATEUR RADIO  
LIKE**

**73 Amateur  
Radio Today**

**2 ISSUES ONLY \$19.97!**

**DON'T MISS OUT!**  
**SUBSCRIBE TO**  
***Radio Fun***

**FOR ONLY \$12.97!**

**12 GREAT ISSUES!**

**CONTACT YOUR  
ADVERTISERS  
EASILY!**

**FILL OUT THIS  
FREE  
READER SERVICE CARD  
AND SEND IT TODAY!**

**NO OTHER  
MAGAZINE BRINGS  
YOU THE EXCITING  
WORLD OF  
AMATEUR RADIO  
LIKE**

***73 Amateur  
Radio Today***

**12 ISSUES ONLY \$19.97!**

YES! Send me one year (12 issues) of Radio Fun for the low price of \$12.97.

For instant service call toll free **1-800-257-2346**. (In New Hampshire, call 603-924-0058).

Name \_\_\_\_\_ (please print) \_\_\_\_\_ Call \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Charge my:  MC  Visa  Payment enclosed

Card Number \_\_\_\_\_ Exp. date \_\_\_\_\_

Class License \_\_\_\_\_ Year Licensed \_\_\_\_\_ 73 Subscriber \_\_\_\_\_ QST Subscriber \_\_\_\_\_ CQ Subscriber \_\_\_\_\_

Canada add \$8. Foreign add \$12 surface, \$36 airmail. Newstand rate \$24. Basic subscription rate \$14.97. 05R

# Radio Fun

## READER SERVICE CARD

February 1993

THIS CARD VALID UNTIL 3/31/93

NAME	CALL	1	2	3	4	5	6	7	8	9	10	201	202	203	204	205	206	207	208	209	210
		11	12	13	14	15	16	17	18	19	20	211	212	213	214	215	216	217	218	219	220
		21	22	23	24	25	26	27	28	29	30	221	222	223	224	225	226	227	228	229	230
		31	32	33	34	35	36	37	38	39	40	231	232	233	234	235	236	237	238	239	240
		41	42	43	44	45	46	47	48	49	50	241	242	243	244	245	246	247	248	249	250
		51	52	53	54	55	56	57	58	59	60	251	252	253	254	255	256	257	258	259	260
		61	62	63	64	65	66	67	68	69	70	261	262	263	264	265	266	267	268	269	270
		71	72	73	74	75	76	77	78	79	80	271	272	273	274	275	276	277	278	279	280
		81	82	83	84	85	86	87	88	89	90	281	282	283	284	285	286	287	288	289	290
		91	92	93	94	95	96	97	98	99	100	291	292	293	294	295	296	297	298	299	300
		101	102	103	104	105	106	107	108	109	110	301	302	303	304	305	306	307	308	309	310
		111	112	113	114	115	116	117	118	119	120	311	312	313	314	315	316	317	318	319	320
		121	122	123	124	125	126	127	128	129	130	321	322	323	324	325	326	327	328	329	330
		131	132	133	134	135	136	137	138	139	140	331	332	333	334	335	336	337	338	339	340
		141	142	143	144	145	146	147	148	149	150	341	342	343	344	345	346	347	348	349	350
		151	152	153	154	155	156	157	158	159	160	351	352	353	354	355	356	357	358	359	360
		161	162	163	164	165	166	167	168	169	170	361	362	363	364	365	366	367	368	369	370
		171	172	173	174	175	176	177	178	179	180	371	372	373	374	375	376	377	378	379	380
		181	182	183	184	185	186	187	188	189	190	381	382	383	384	385	386	387	388	389	390
		191	192	193	194	195	196	197	198	199	200	391	392	393	394	395	396	397	398	399	400

## FREE PRODUCT INFORMATION

05U

**Reader Service:** To receive more information on the products advertised in this issue of Radio Fun circle appropriate number. Please allow 6 weeks for processing of inquiry. Offer valid in the U.S. and possessions only.

**YES!** I want to grow with  
**73 Amateur Radio Today.**

Send me 1 year (12 issues in all) of 73 for the low price of \$19.97! (Save over \$15.00 off the cover price). Mail this postage paid card today. For instant service call toll free: 800-289-0388 (In Colorado, call 303-447-9330).



Name \_\_\_\_\_ (please print) \_\_\_\_\_ Call \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Payment enclosed  Bill me

Charge my:  MC  Visa  Amex

Card Number \_\_\_\_\_ Exp. date \_\_\_\_\_

Newsstand rate \$35.40. Basic subscription rate \$24.97 (Canadian orders add \$7.00 per year plus \$1.40 GST; other foreign countries add \$19.00 per year for surface mail, \$42.00 per year for airmail. Please allow 4-6 weeks for delivery of first issue.

4QCD8

**BUSINESS REPLY MAIL**

FIRST CLASS

PERMIT NO 211

MANCHESTER NH

POSTAGE WILL BE PAID BY ADDRESSEE

**Radio Fun**

PO Box 4926  
Manchester NH 03108-9839

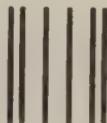
NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES



Place  
Stamp  
Here

**Radio Fun**

READER SERVICE MANAGEMENT DEPARTMENT  
PO BOX 8708  
BOULDER CO 80329-8708



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY MAIL**

FIRST-CLASS MAIL

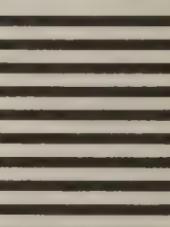
PERMIT NO. 1199

BOULDER CO

POSTAGE WILL BE PAID BY ADDRESSEE

**73 Amateur  
Radio Today**

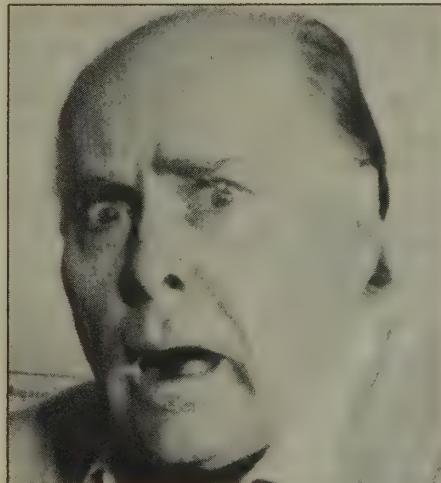
P.O. BOX 50330  
BOULDER CO 80321-0330



# advertiser index

RS#	ADVERTISER	PG	RS#	ADVERTISER	PG	RS#	ADVERTISER	PG
18	A.S.A.	14	240	Jan Crystals	15	32	Ryan Communications	14
•	Advanced Electronic Applications	CV2	84	JLP Computers & Electronics	20	153	Satellite City	19
275	Antennas West	20	2	Kawa Productions	21	35	Sign On	19
16	Astron Corporation	7	234	Lentini Communications	27	244	Software Systems	21
105	Battery Tech, Inc.	11	274	M2 Enterprises	13	250	Software Systems	14
184	C & S Sales, Inc.	26	101	Maxcom, Inc.	23	247	Startek	CV4
146	Creative Control Products	14	86	MFJ Enterprises	5	119	Tiare Publications	20
130	Dandys	23	98	Microcraft Corporation	21	269	Tigertronics	10
231	Douglas RF Devices	21	114	Mr. Nicad	18	299	Townsend Electronics	22
114	E. H. Yost	18	21	N4ZDU Shareware	22	11	Transel Technologies	20
157	Echotrax	14	•	Oklahoma Comm Center	20	•	Uncle Wayne's Bookshelf	29
•	Electronic Distributors	27	•	P.C. Electronics	26	136	Unadilla Antenna Manufacturing Company	25
118	Flytecraft	21	152	PacComm	17	•	Universal Radio	20
251	Flytecraft	27	68	Peripherx	18	•	Vanguard Labs	20
•	Get-Tech	14	132	Quement Electronics	16	14	VHF Communications	21
193	GGTE	21	110	Radio Amateur Satellite	25	104	Vis Study Guides, Inc.	23
182	Handie-Base	21	153	Radio City	19	•	Yaesu Electronics Corporation	CV3
300	Hart Publishing	9	•	Radio Fun	17			
55	J-Com	26	34	Ramsey Electronics	25			

## What are you . . . nuts?



Our founder, Wayne Green W2NSD, upon hearing that you were not yet subscribing to *Radio Fun*.

I'm shocked! I'm outraged! I'm beside myself and I'm flabbergasted!

You mean to tell me that *Radio Fun* has been around for a whole year, and you *still* haven't subscribed?

Even though you're aware that *Radio Fun* is the *only* amateur radio magazine devoted to the newcomer? Even though we pack every issue of *Radio Fun* with easy construction projects, interesting news, great reviews of new and vintage gear . . . not to mention our columnists, who are devoted to helping you learn more about, and have more fun with, amateur radio?

OK. We'll just forget your past indiscretions and start fresh. We'll send you 12 issues of *Radio Fun* for the amazingly generous price of \$12.97. Hey . . . that's almost 1/2 off the cover price! Just use the convenient postcard attached to the center of this magazine, or you can call toll free, 1-800-257-2346, and charge your subscription. Either way, let's get this taken care of.

**1 year of *Radio Fun* for only \$12.97! Call 1-800-257-2346.**



## HandiPacket<sup>®</sup> PORTABLE PACKET CONTROLLER

"One of PacComm's Handipackets is  
Aboard the MIR Space Station  
Listen for U2MIR on 145.55 MHz"



## PacComm

- Advanced Technology
- Enduring Value

4413 N. Hesperides St., Tampa, FL 33614-7618  
(813) 874-2980 Fax: (813)872-8696 (800)486-7388

**Leading Provider of Packet Equipment for Amateur Radio**

Get a beginner's packet setup, for only \$65!

A serial port modem for your PC and a 'software TNC' diskette

Simply plug into the PC serial port and connect to your radio

Order BayMod-9 or Baymod-2

CIRCLE 152 ON READER SERVICE CARD

# BATTERIES

Nickel-Cadmium, Alkaline, Lithium, Sealed Lead Acid For Radios, Computers, Etc. And All Portable Equipment

YOU NEED BATTERIES?  
WE'VE GOT BATTERIES!  
CALL US FOR FREE CATALOG

E.H. YOST & CO.  
7344 TETIVA RD.  
SAUK CITY, WI 53583  
(608) 643-3194  
FAX 608-643-4439



CIRCLE 114 ON READER SERVICE CARD

REMEMBER...A LOW COST POWER PACK  
WITHOUT PERIPHEX'S QUALITY IS NO BARGAIN



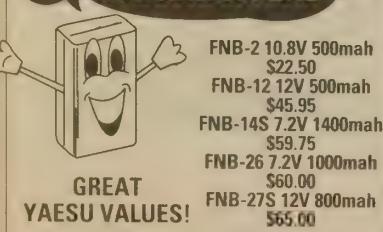
SUPER PACKS FOR  
ICOM 2/4SAT, 24AT & W2A



BP-83S 7.2V 750mah  
\$43.50  
BP-84 7.2V 1000mah  
\$57.00  
BP-84S 7.2V 1400mah  
\$63.00  
BP-85S 12V 800mah  
\$76.00  
  
BP-114S 12V 800mah  
\$79.00

SAVE ON THESE POPULAR  
PERIPHEX POWER PACKS  
BP-7S 13.2V 1200mah ... \$65.00  
BP-8S 9.6V 1200mah ... \$65.00

CALL FOR OUR  
SPECIAL OFFERS



NEW BATTERIES  
AVAILABLE. CALL!

KENWOOD  
PB-8S 12V 800mah  
\$59.00  
PB-13S 7.2V 1200mah  
\$49.75  
PB-25/26S 8.4V 900mah  
\$65.00

Manufactured in the U.S.A. with matched cells, these Super Packs feature short circuit and overcharge protection, and a 12 month warranty. All inserts and packs in stock or available from authorized dealers

CALL US TO DISCUSS YOUR BATTERY REQUIREMENTS



Add \$4.00 S & H FOR FIRST BATTERY, \$1.00 FOR EACH ADD'L BATTERY - U.S. ONLY. Connecticut residents add 6% tax

**PERIPHEX inc.**  
115-1B Hurley Road, Oxford, CT 06478

800-634-8132

In Connecticut 203-264-3985 - FAX 203-262-6943

CIRCLE 68 ON READER SERVICE CARD



## what's next?

by Carole Perry WB2MGP

### Fun With Magnetism

If you're a teacher or volunteer instructor of ham radio you already know the value of providing lots of hands-on excitement for your students so that their learning experiences can be optimized. If you are a student in a formal school setting or an attendee in an evening license class, you might enjoy bringing in some fun ideas to share with your class. We all learn better when we're involved, active participants in our own learning process. When I introduce any new unit to my 6th, 7th, and 8th grade ham radio classes, I do my homework first.

At the beginning of each term we learn about magnetism and electricity. The materials and experiments that I'll share with you can be adapted to any age group. Since the backgrounds and abilities of every class are different, it is the teacher's responsibility to make sure that the lesson will be relevant and comprehensible to the particular group he or she is working with.

Historically, our knowledge of magnetism and our knowledge of electricity are two separate streams, originating in antiquity and merging near the beginning of the last century. In nature, however, magnetism and electricity are intimately related forms of energy, each one capable of producing the other.

The phenomenon of magnetism has been known for centuries. The fact that certain kinds of iron or iron ore had the power to attract other bits of material containing iron must have been known in ancient Greece. The name "magnet" probably comes from Magnesia, a province in northern Greece where large deposits of magnetic ore were found. Magnets became an important instrument in navigation when it was discovered that if one was suspended so that it could turn freely it would swing into a north-south position; thus, the magnet becomes a compass. Some legends ascribe this knowledge to the ancient Chinese. Over one thousand years ago they presumably were using magnets as compasses. In the writings of Hebrews, Greeks and Romans, the magnet is often referred to as a "lodestone," meaning "leading-stone" or "directing-stone."

The classroom teacher can have some of the youngsters research the significance of this discovery from a historical perspective, while another group presents its findings from a scientific viewpoint. When the 6th graders at my school study about Columbus and the discovery of the New World, they are able to add enrichment activities and interesting follow-up projects to their social studies classes by pointing

out how the invention of the compass made it possible for men to venture out into the great unknown—the oceans of the world. I always try to coordinate my lessons with the social studies and science teachers. Ham-radio-related curriculum can provide highly motivational material for other subject areas.

### The "Anti-Gravity Machine"

One of the experiments the kids have a lot of fun with is constructing an "Anti-Gravity Machine." The materials you'll need are a drinking glass, a magnet, some tape, a paper clip, and about a foot of thread. Set the magnet across the top of the glass so that one end extends over the rim. Tie the thread to the clip and stick it to the magnet. Tape the thread to the table and begin pulling the thread gradually through the tape until you've pulled the clip off the magnet. Keep pulling until the clip is an inch or so from the magnet. Stick the tape down extra hard to keep the thread from pulling through anymore.

Leave the clip there, suspended in mid-air, straining on its leash, caught in a real-live "tractor beam." This always amazes the kids. As the class watches the clip pulling on the thread, they should focus on the empty space between the clip and the magnet. It's a great classroom demonstration on showing that there is a force at work. The children, or whoever is observing this, will probably wonder if the force can be blocked.

Have some inexpensive materials ready to do some follow-up experiments at this time. Put a piece of fabric in the space; don't touch either the magnet or the clip. Does anything happen? How about a piece of plastic? What happens with aluminum, glass, a penny, or a piece of paper? Have a student stick his whole finger in there and see what happens. Next, try another paper clip, or a fork. Have a group of students record all the observations. This leads you to the next question: "Why do some things cause the clip to drop, and others don't?"



Photo A. Eighth graders having fun doing experiments with a magnet and a glass.



Photo B. The unit on magnets leads to a discussion about the earth's magnetic poles.

### "Dinnertime Magic"

John Cassidy's *Explorabook* has a great "Dinnertime Magic" trick that all the children love to perform at home. Always remember that "fun" is the name of the game. Tell the kids to take a magnet and strap it with a belt or shoelace to the top of their thigh underneath their pants or skirt. They'll also need a fork and a paper clip. Here's how the "magic" goes:

Wait 'til everyone is seated around the dinner table (wooden, not metal). The student then crosses his legs so that the magnet is pressed tight against the underside of the table. The paper clip should be in a shirt pocket. The child then tells his unsuspecting family that he has discovered that he possesses strange "new powers." He has "discovered" that he's been able to bond certain metals, one to the other, with a mentally-powered cold fusion process. It's a very lightweight bond, of course, and also temporary since it only works during moments of intense concentration. The child should offer to do a demonstration at this time.

Slowly, he should push the paper clip directly over the hidden magnet and gently place the fork on top of it. The child should close his eyes, moan, take a noisy deep breath, hold it, and puff out his cheeks. The "magician" should next open his eyes, drop the magnetized leg away from the table, and very carefully lift the fork up. The clip will stick to it. The child should stand up and gently wave the fork and clip around for effect.

After a few seconds of demonstration, the child should exhale in a burst and simultaneously give the fork an invisible shake. The clip will drop loose. Bang the fork once against the table top (this is important) and then pass both the fork and clip around for inspection. The child doesn't have to worry since it won't work for anyone else.

Remember that a good magician never reveals his tricks. Only the youngster will know that by placing the fork and clip over the magnet he was able to "convert" them into magnets (albeit weak magnets). By rapping the fork on the table, the child has demagnetized it for everyone else.

There are lots of experiments in thousands of textbooks in schools across the country. The important thing for the teacher to keep in mind is that effort put into searching out the most exciting and stimulating experiments will be well worth it when you see eager, learning students in front of you.

If you would like to share some of your best classroom experiments, either join us on the CQ All Schools net on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz, where school kids and teachers from all across the country converge to share experiences, or write to me and send photos of your best times.

Please note that any enthusiastic and articulate youngster who is interested in being interviewed for the '93 Dayton Youth Forum should contact me by phone at (718) 983-1416, or by writing to me at P.O. Box 131646, Staten Island NY 10314.



## Ramsey AA-7 All-Band Active Antenna

by David Cassidy N1GPH

So . . . you've never built a kit before, but you'd sure like to try it. You've tried a couple of kits, or maybe tried building something from plans in a magazine, but have ended up with a modern art sculpture instead of a working circuit. Maybe you're an old hand at solder-flinging and you'd just like a nice, easy, one-evening project that would provide you with a useful shack accessory. The Ramsey AA-7 Active Antenna kit will please all of you described above, and then some.

Let me admit at the outset that I am perhaps the world's worst kit builder. My sol-

der joints look like toothpaste, I'm always losing the small parts and more often than not I end up with a non-working circuit. The instructions that come with many kits often leave me wondering what to do, and I inevitably make the wrong choice. I have a very large box filled with non-working projects that attest to my lack of prowess as a kit builder. Though many writers say it, in my case it is true: If I can build it, *anyone* can build it! That's why I enjoyed the AA-7 kit so much. I spent a pleasant Saturday morning, didn't burn myself on the soldering iron, and I ended up with a nice

completed project before the coffee ran out. What more could you ask for?

### What is an Active Antenna?

Without going into technical detail, an active antenna can be defined as an antenna—usually quite a bit shorter than would normally be used for a given frequency—connected to an RF preamplifier and then to your receiver. The RF preamp is a low-noise impedance transformer, matching the high impedance of the whip (or other) antenna to the low impedance radio input, thereby "boosting" the received signal be-

Ramsey Electronics, Inc.  
793 Canning parkway  
Victor NY 14564  
(716) 924-4560  
Fax (716) 924-4555  
Price: \$24.95  
Matching Case: \$12.95

fore it goes to your receiver. Some RF preamps are broadband, which means they will work on a wide frequency range. Other RF preamps are designed to be used on one specific frequency, and a third type are tunable, allowing you to peak the received signal for the frequency you're monitoring. The Ramsey AA-7 is of the broadband type, and like most preamps it is designed for receive only. Preamps can be designed for transmit, but these are usually quite expensive and require more complicated circuitry.

The Ramsey AA-7 incorporates two RF preamps, which are switchable via a front panel switch. With the power off, the preamp is taken out of the line, so you can leave the AA-7 permanently installed on your scanner or shortwave receiver and have non-amplified access to the external antenna jack or whip antenna. With the power on (supplied by a 9-volt battery), you have a choice of two RF preamps. One is optimized for HF applications, and the other gives excellent VHF-UHF perfor-

Photo A. The completed AA-7 circuit board.

mance, especially if you also adjust the length of the on-board whip antenna for best reception.

### Building the AA-7

One of the best things about building a Ramsey kit is the instruction manual. Even a simple kit like the AA-7 comes with a 12-page manual that gives you a little

## No-Hands!

When your hands are busy, where do you want your HT? Ask firefighters, police, construction workers, forest rangers, ski patrols, SWAT teams, and paramedics. They designed our chest mounted Rescue Pouch so they could listen without an earpiece and talk straight into it no-hands. Diagonal positioning of HT places antenna over the shoulder not in your face. Made of padded rot-proof Cordura with quick-release buckles. Adjusts to grab any size HT. Unique Double model holds two HTs or HT and spare battery.

Single \$31. Double \$41. Add \$3 P&H

**AntennasWest**  
Box 50062-F, Provo UT 84605



Order Hotline:  
**800-926-7373**

CIRCLE 275 ON READER SERVICE CARD

## SPY ON THE EARTH



See live on  
your PC  
what  
satellites in  
orbit see

Learn how you can benefit greatly from this exciting new technology. Send \$30 (\$35 air, \$40 overseas) for our *fantastic* 12 diskette set of professional quality copyrighted programs (IBM type) that does satellite tracking, data acquisition, image processing, file conversion and much more. Diskette and information package includes all programs, satellite views, C language source code for a popular satellite image acquisition program, hardware schematics, catalog and discount certificate.

**VANGUARD Electronic Labs**  
Dept. RF, 196-23 Jamaica Ave.  
Hollis, NY 11423 Tel. 718-468-2720

\$ BEST PRICES ON PC PARTS \$			
COMPLETE LINE OF COMPONENTS			
MOTHER BOARDS		HARD DRIVES	
386SX-25	\$139	IDE106 Mb	\$289
386DX-40	\$259	IDE 130 Mb	\$329
486DLC-33	\$499	IDE 213 Mb	\$429
1.2 Fdd	\$57	1.44 Fdd	\$52
250 Mb tape back up int.			\$249
CALL FOR OTHER PRICES			
<b>JLP</b>			
COMPUTERS & ELECTRONICS			
2895 Pontiac Lk. Rd.			
Waterford, MI 48328			
<b>1-800-497-9735</b>			

CIRCLE 84 ON READER SERVICE CARD

Isn't Your Radio Worth The Investment?

Protect It With



Protect your HT's, Cellular Phones, Pagers, and any other devices you carry that may be subject to damage.

The PACK-IT is made of 1/4" neoprene material which is safety belt sewn to the nylon protective backing. The PACK-IT doesn't fray like many other materials and is safe to wash whenever needed.

The strap and 2" beltloop is made from commercial grade webbing and is secured in the front with a Velcro hook and loop assembly.

The PACK-IT doesn't wear the radio like leather and protects the radio from the small falls which occurs in everyday usage. The neoprene material is a cushion material which not only covers the radio but also protects it. Various sizes available so call for the size to fit your need.

Made In The USA!

**\$15.95** + \$3.00 S&H  
**1 (800) 829-8321**

Dealers Welcome

CIRCLE 11 ON READER SERVICE CARD

## GREAT RADIO READS!

TIARE

### Low Power Communications

Vol. 1 - Basic QRP ..... \$14.95

### Basic Guide to VHF/UHF Ham Radio

..... \$ 6.95

### Weather Radio NOAA, Volmet, Fax, Satellites, more

..... \$14.95

\$ U.S. only.

Add \$2 s/h (\$3 foreign) plus  
\$1 each additional book.  
VISA/Mastercard welcome.  
Catalog \$1 (free with order).

Order Now

Tiare Publications  
P.O. Box 493  
Lake Geneva, WI 53147

CIRCLE 119 ON READER SERVICE CARD

## HUGE NEW CATALOG

Call or write Universal today  
to receive your free 100  
page catalog with prices!

- Communications Receivers
- Portable Receivers
- Amateur Transceivers
- Amateur & SWL Antennas
- Scanners
- RTTY and FAX Equipment
- Books and Manuals
- All major lines: Kenwood, Icom, Yaesu, Alinco, MFJ, Japan Radio, AEA, Sony and Sangean.

This catalog is available **FREE** by fourth class mail, or for \$1 by first class mail.



**Universal Radio**

6830 Americana Pkwy.

Reynoldsburg, OH 43068

◆ Tel. 614 866-4267

◆ Tel. 800 431-3939

◆ FAX 614 866-2339

*Universal-quality equipment since 1942!*

**Oklahoma Comm Center**

**ALINCO ICOM YAESU**

## SPECIAL SPECIAL

### CALL

For This Month's Special-Buy  
Some Quantities Are Limited

FREE SHIPPING UPS SURFACE  
(on purchases of \$50.00 or more except antennas)

3900 S. Broadway, Suite 6  
Edmond, Oklahoma 73013  
Local & Info (405) 359-9554  
Fax (405) 359-9556

**C.O.D.**  
**CALL TOLL FREE**  
**1-800-70K-HAMS**  
**1-800-765-4267**

Hours of Operation  
M-F 10-6  
Sat 10-2

Showroom closed Mondays

bit of the theory of operation and then step-by-step instructions on building the kit. Anyone who carefully reads each step should have no problem completing the kit.

The instruction manual leads you through the construction process, following the circuit path as you go. Whenever possible, this is a great way to build a kit because you learn a lot about how the circuit works as you build it. I wish every other kit manufacturer would follow Ramsey's lead in quality manuals.

With the full-size parts placement guide on one side of your workbench, and the step-by-step instructions on the other, the AA-7 kit goes together in about an hour. You start with the antenna jack, then follow the circuit path, adding necessary parts as you go. When you get to the receiver jack at the other end of the circuit, all you do is add the battery and antenna and you're done! Each step of the instructions has you add a single component, whether jack, switch, capacitor or resistor. The exact value of each component is given (not just the part number), and how to identify that component (resistor color code, etc.). As long as you know how to make a good solder connection, I can't see how anyone would be unsuccessful at building the AA-7.

### Testing and Installation

One of the reasons I recommend the AA-7 for beginners is that there is absolutely no testing. Wire up a coax cable, attach to your receiver and turn it on. If it works, you'll know immediately because you'll hear the difference in your receiver's speaker.

After wiring up a short piece of coax, I first tested my AA-7 on a hand-held scanner. This is a perfect application for the AA-7 because it allows for increased performance when you're stuck with an indoor antenna. Scanner buffs who like to take their hand-held scanner with them when they travel should be especially interested in this. I tuned in an active chan-

nel, adjusted the RF gain control for maximum signal, adjusted the length of the whip antenna, tweaked the RF gain one more time and that's it. The received signals are remarkably improved, especially when compared to the hand-held scanner's supplied antenna.

Next, I attached the AA-7 to my HF transceiver. (If you do this, make absolutely sure that you never key the transmitter. This will send power into the circuit and probably cook the transistors to a crispy, golden brown.) Even using the attached whip antenna gave fair results, much better than what you'd get from a portable shortwave receiver's whip antenna. When I attached

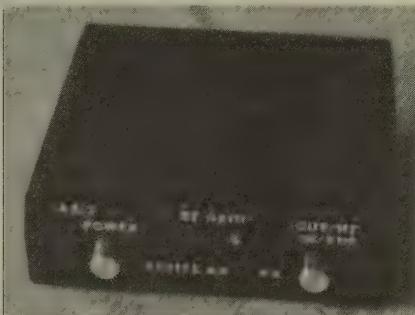


Photo B. Front view of the completed project, with the Ramsey accessory case.

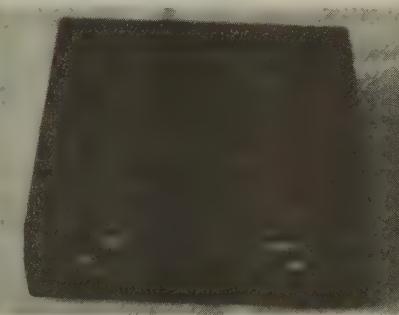


Photo C. Rear view of the AA-7 in the accessory case.

my 80 meter dipole to the external antenna jack of the AA-7, the results were truly astounding! Tune in a weak signal, hit the power on the AA-7 and voilà! Instant armchair copy! The possible applications for shortwave monitoring are numerous. Anyone who uses a portable shortwave receiver with the stock antenna should definitely build an AA-7. Even serious SWL DX chasers with outdoor antennas would benefit from installing an AA-7.

### On the Case

The only disappointment experienced at all with this kit was in the accessory case, offered for an additional \$12 from Ramsey.

The case comes with no instructions, and while it doesn't take a rocket scientist to figure out how the case goes together, a paragraph or two with an exploded view drawing would be nice (especially for first-time kit-builders).

The only other gripe I have with the case is that in order to use it you have to leave off the whip antenna. There's no provision for it, nor is there any

instruction on how to attach the whip once you've enclosed the circuit board in the case. Unless you modify the case somehow, you are forced to use the RCA jack on the back. To my thinking, this limits the usefulness of the AA-7 as a "throw it in your suitcase and go" active antenna.

To get around this, I plan on buying a whip with a right-angle swivel, mounting it on the side of the AA-7 case, and running a lead from the antenna to the point on the PC board where the whip should go. I suppose it would be a lot easier to simply solder an RCA plug to a piece of wire and wrap the wire around the case before throwing it in my suitcase, but I like the idea of a collapsible and swiveling whip. I also plan on adding a "power on" LED indicator, which the AA-7 instruction manual shows you how to do.

All in all, I think the AA-7 would make a great introduction to kit-building for any novice solder slinger. If you like to monitor shortwave broadcasts and public service frequencies while you travel (like I do), then the AA-7 is really a must. With the Ramsey case/knob kit, I have a rugged and very portable piece of equipment that dramatically improves the performance of my portable receivers.

RF

### MORSE CODE MUSIC?

New-Powerful-Breakthrough, All 43 Morse Code characters sent with a rhythmic beat. A fun & easy way to learn or retain Morse Code skills. Now the secret is yours! Order "THE RHYTHM OF THE CODE"™ Version II cassette today!

Send \$9.95 and we'll pay the shipping to:

**KAWA PRODUCTIONS**  
P.O. Box 319-RF.  
Weymouth, MA 02188.

Check or money order only. We ship all orders within 10 days. Outside U.S.A. please add \$2. for air mail. MA residents please add 5% sales tax.

CIRCLE 2 ON READER SERVICE CARD

### The Choice Is Yours!

#### CODE SCANNER OR CODE STAR



✓ MORSE  
✓ RTTY  
✓ ASCII  
✓ SPEAKER  
✓ CPO  
*Made In USA*

CODE SCANNER - compact, lightweight, 32 character LCD display. \$189. S&H \$6.  
CODE STAR - 8 large easy-to-read LEDs. Kit \$139. Wired \$179. S&H \$6.  
(Optional ASCII Output Port Available.)  
Free Brochure. Call-Write-Order. MC/VISA.

*Microcraft Corporation*  
Box 513RF, Thiensville, WI 53092  
Phone (414) 241-8144

CIRCLE 98 ON READER SERVICE CARD

Listen to  
"Let's Talk Radio" 7 nights a week  
6pm to 12 pm on  
Spacenet-3,  
Transponder-21,  
Audio 6.2

**VHF**  
COMMUNICATIONS

453 Buffalo Street  
Jamestown, New York 14701

9:00 am - 5:30 pm  
weekdays

Weekends and evenings  
by appointment.

Western New York's finest amateur radio dealer.  
PH. (716) 664-6345  
(800) 752-8813 for orders only

CIRCLE 14 ON READER SERVICE CARD

### DUCKTAILS! Counterpoise Radials

Dramatically Improves Your HTs Performance!

only \$4.95

Douglas RF Devices

P.O. Box 246925 • Sacramento, CA • 95824

Specify band(s) when ordering. Dual band add \$1.00.

CIRCLE 231 ON READER SERVICE CARD

### Most Revolutionary High-Frequency Amateur Radio Antennas in 20 years!

#### The FLYTECRAFT™ SFX Line of Monoband Vertical HF Antennas

• 5 unique models for 40, 30, 20, 15, 10 meters. Each only 9 ft. tall (10 meter is slightly shorter) • Precision internal wound helix gives full-size, incredible performance - world-wide DX or domestic. • Praise from everywhere: ENGLAND - "Your vertical sounds great!" CZECH. - "I can't believe your antenna is only 3 meters high!" • Instant set-up and tear down, or leave up permanently - unobtrusive; ideal for antenna-restricted areas. Separates down to 4 ft. • Antennas boast low angle radiation. • Easiest-To-Use antenna made! Uses 2 shortened radials with RADIALCOILS™ - stretch them out or coil them up. (10M uses 3)

Designed by TV's Emmy-Winning Steve Flyte, K7SF

Built with pride & sold worldwide • FLYTECRAFT™ USA

40 thru 15 meters ~ \$99.95 ea. 10 meters ~ \$89.95 ea. Add \$6.50 s/h, contin. U.S. 10% Discount on 2 or more.

Satisfaction Guaranteed  
VISA/MC PHONE ORDERS  
805 - 583 - 8173  
Mon thru Fri 9A - 5P (PT)

CIRCLE 118 ON READER SERVICE CARD

### Why buy a TNC?

PC HF FAX + PC SWL \$179.00

#### SPECIAL COMBINATION OFFER

For a limited time, if you order PC HF FAX \$99 (see our other ad in this issue), you can add our new and improved PC SWL 3.0 for \$80.00 instead of our regular low price of \$99.00.

PC SWL contains the hardware, software, instructions and frequency lists needed to allow you to receive a vast variety of digital broadcasts transmitted over shortwave radio. All you need is any IBM PC or compatible computer and an SSB shortwave receiver. The product consists of:

Demodulator  
Digital Signal Processing Software  
200 Page Tutorial Reference Manual  
World wide Utility Frequency List  
Tutorial Audio Cassette with Samples

PC SWL automatically decodes Morse code, RTTY, AMTOR, SITOR, NAVTEX and ASCII.

PC SWL lets you tune in on world press services meteorological broadcasts, ham radio operators, coastal shore stations, aviation telex and much more digital action on the shortwave bands. Why pay for another expensive box when a simple interface and your PC can do the job?

**ADVANCED FEATURES:**

Tuning Oscilloscope  
Digital Waveform Presentations  
Auto Calibration and Code Recognition  
Continuously Tunable Filter Frequencies  
Variable Shift  
Adjustable CW Filter Sensitivity  
Unattended Capture and Printing  
Integrated Text Editor  
Integrated Log and Database  
Shell to DOS Applications  
Seamless Integration with PC HF Facsimile

Call or write for our complete catalog of products.  
Visa & MasterCard welcome.

**Software Systems Consulting**  
615 S. El Camino Real, San Clemente, CA 92672  
Tel: (714) 498-5784 Fax: (714) 498-0568

CIRCLE 244 ON READER SERVICE CARD

Sell your used gear in the  
**Radio Fun**  
Flea Market  
Call Judy Walker  
today.  
**1-800-274-7373**

### HANDIE-BASE

(PATENT MAILED)

For Your Handheld Radio or Handheld Scanner. Features Include: Solid Walnut Base, Powder Coated Steel Frame, Non-slip Rubber Feet, 5 year Warranty. Models Available for Most Radios or Scanners. Works on Desktops, Tabletops, Work Benches, or any Flat Surface. Add An Extension Speaker/Mic, Power Supply & External Antenna and it Converts Your Handheld Radio

into A Base Station. To order send \$14.95 plus \$3.50 shipping to:

Handle-Base & More Inc.  
P.O. Box 2504, Dept. D-2  
Broken Arrow, OK 74013-2504

(Please Specify the Size of Your Handheld Radio - Small or Regular)

CIRCLE 182 ON READER SERVICE CARD

### SCARED OF THE CODE?

IT'S A SNAP WITH THE ELEGANTLY SIMPLE MORSE TUTOR ADVANCED EDITION FOR BEGINNERS TO EXPERTS—AND BEYOND

Morse Code teaching software from GGTE is the most popular in the world—and for good reason. You'll learn quickest with the most modern teaching methods—including Farnsworth or standard code, on-screen flashcards, random characters, words and billions of conversations guaranteed to contain every required character every time—in 12 easy lessons.

Sneak through bothersome plateaus in one tenth of a word per minute steps. Or, create your own drills and play them, print them and save them to disk. Import, analyze and convert text to code for additional drills.

Get the software the ARRL sells and uses to create their practice and test tapes. Morse Tutor Advanced Edition is approved for VE exams at all levels. Morse Tutor is great—Morse Tutor Advanced Edition is even better—and it's in user selectable color. Order yours today.

For all MS-DOS computers (including laptops).

Available at dealers, thru QST or 73 or send \$29.95 + \$3 S&H (CA residents add 7.75% tax) to:

**GGTE, P.O. Box 3405, Dept. MS,**  
Newport Beach, CA 92659  
Specify 5 1/4 or 3 1/2 inch disk  
(price includes 1 year of free upgrades)

CIRCLE 193 ON READER SERVICE CARD.

IMPROVE YOUR LOOKS,  
HEALTH AND POPULARITY.



QUIT SMOKING.

American Heart Association  
© 1992, American Heart Association

Subscribe  
To  
**Radio Fun**  
Call  
**1-800-257-2346**

Townsend Electronics, Inc.

presents

C.M. Howes Kits  
for  
H.F. Amateur Equipment



**"RIG SAVER"**  
H.T. and Mobil Mounts



**THE WORLD'S BEST**  
in ham radio books and publications  
28 page catalog \$1.00

Outside USA \$2.00

1-219-594-3661

Townsend Electronics, Inc.  
Box 415R • Princeton, IN 46562

CIRCLE 299 ON READER SERVICE CARD



# upgrade don't stop now

by Gordon West WB6NOA

## Learn From Your Antenna

Your Novice and Technician class examinations each contain three questions on antennas and feedlines. More than likely you had an examination question or two about yagi antennas and quad antennas. What do these two antennas have in common? That's right—both the yagi and the quad antenna are DIRECTIONAL.

The yagi antenna consists of half-wave linear elements mounted on a boom. The quad antenna features full-wavelength squares, attached to "spreaders," mounted on a boom. The longer the boom, the greater the gain; the higher the frequency, the smaller the elements. Also, both antennas consist of multiple directors, one driven element, and one reflector. The directors are approximately five percent smaller than the driven element, and the reflector is about five percent larger than the driven element. Remember all that when you were preparing

for Novice and Technician?

As a licensed radio amateur, you will regularly be working with directional antennas. On the worldwide bands, they can weigh as much as 100 pounds and have 20-foot arms and a boom over 30 feet long! Up on the 2 meter and 440 MHz bands most yagi antennas and quads are about 12 feet long, and their elements are generally less than three feet from tip to tip. The higher you go in frequency, the shorter the wavelength, and the smaller the directional yagi or quad gets.

Understanding gain and directivity is important. You can read about it all day long in books, but nothing beats practical experience in working with the directional antenna. There is plenty that you can do to learn about yagis and quads with your little single-band or dual-band handheld.

I recommend you start off with your antenna exploration using a quad. These are safe antennas

around a lot of onlookers. You are less apt to accidentally poke someone with a quad than you are with the pointed ends of a yagi antenna. The quad may also offer a slight improvement on gain.

During our classroom demonstrations, we use the pre-assembled quad antennas from Max System Antennas (106 Western Avenue, Essex MA 01929; 508/281-8892; Attn: Tom Burnie KØTB). Both their 2 meter quad and their 440 MHz quad are fully pre-assembled, and they go "on the air" in less than five minutes. No soldering is required—just get everything in place and you are ready for some experimenting.

Use your little handheld and rubber duck antenna to tune in a distant repeater that is coming in weak. Now switch over to the quad and

rotate it and see the improvement of signal strength on your radio's LCD bar graph signal-strength meter, plus hear the amount of additional "quieting" to the background noise. Swing the quad back and forth, vertically polarized, and notice that the BEAM WIDTH is about 10 degrees of either side of being pointed directly at the distant repeater transmitter. Now, swing the antenna approximately 45 degrees off of the direction of the repeater and notice the deep NULL. The signal should just about drop out completely. Keep rotating the antenna and notice how the signal comes back up again but never quite as strong as the MAIN LOBE. What you are picking up off of the side of the antenna are "SIDE LOBES." Now, turn the antenna exactly backward to the distant repeater. Again, the signal should barely be coming in.

Now turn the antenna so the feedpoint is horizontal with the earth. That is, the wires coming out from the feedpoint are horizontal on that side of the quad. Notice how the repeater dramatically drops in signal strength when you turn the antenna horizontally. Even though the antenna is pointing right at the transmitting repeater, it's not as strong horizontally as it is vertically. This illustrates POLARIZATION. You can use this to your advantage if you're trying to "T-hunt" a signal that is so strong you can't find a

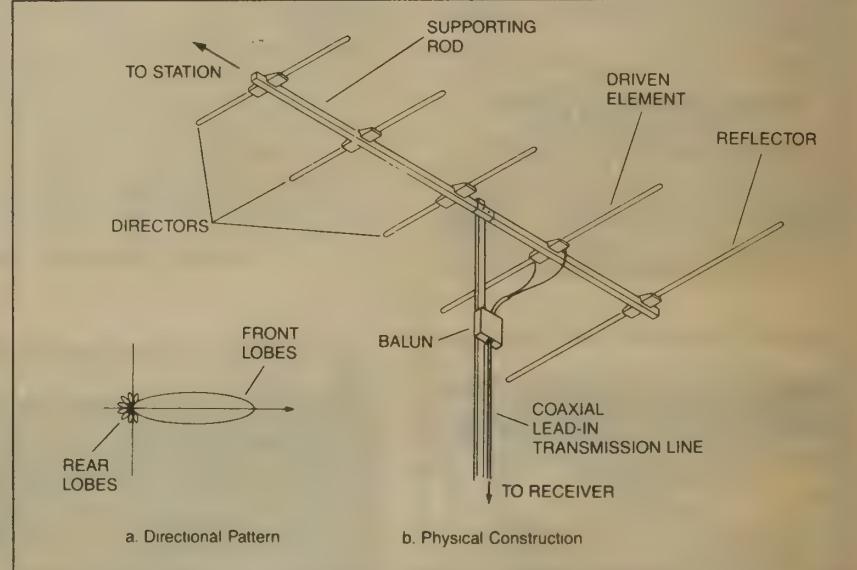


Figure 1. A beam antenna: the yagi antenna. Source: *Antennas—Selection and Installation*, 1986, Master Publishing, Inc.

## CD-ROM Headquarters!

CD-1 500 Best Games.....ONLY \$49.95

CD-2 1000 Best Educational Programs.....ONLY \$49.95

CD-3 1100 Best Business Programs.....ONLY \$49.95

CD-4 All of the above + over 3000 in all!.....ONLY \$139.95

CD-5 Over 20,000 Software Programs on 3 CD set!.....ONLY \$139.95

CD-6 The MONSTER CD over 6000 programs.....ONLY \$99.95

Collect all of these CD's for over 30,000 Programs!

This is probably ALL the software you'll ever need!

All of these CD sets are Different! Collect em ALL.

Phone 1-904-493-0505 Free Catalog on DISK and PRINTED catalog  
1-800-841-6570 C.O.D. orders only.

Catalogs sent with order.

We have almost everything available, specify preference when ordering!

### GIANT COLLECTION ON FLOPPYS

NEWEST AVAILABLE ANYWHERE!

\$29.95 specify 3 1/2 or 5 1/4 disks

At least 10 High Density Disks!

•••••  
Free SHIPPING  
With Paid Order!  
•••••

CIRCLE 21 ON READER SERVICE CARD

C.O.D. add \$4.00

Shipping add \$3.00

SAVE C.O.D./Shipping!

Mail Check or M.O.

TO

**N4ZDU SHAREWARE**  
**P.O. BOX 40**  
**Oldtown, FL. 32680**

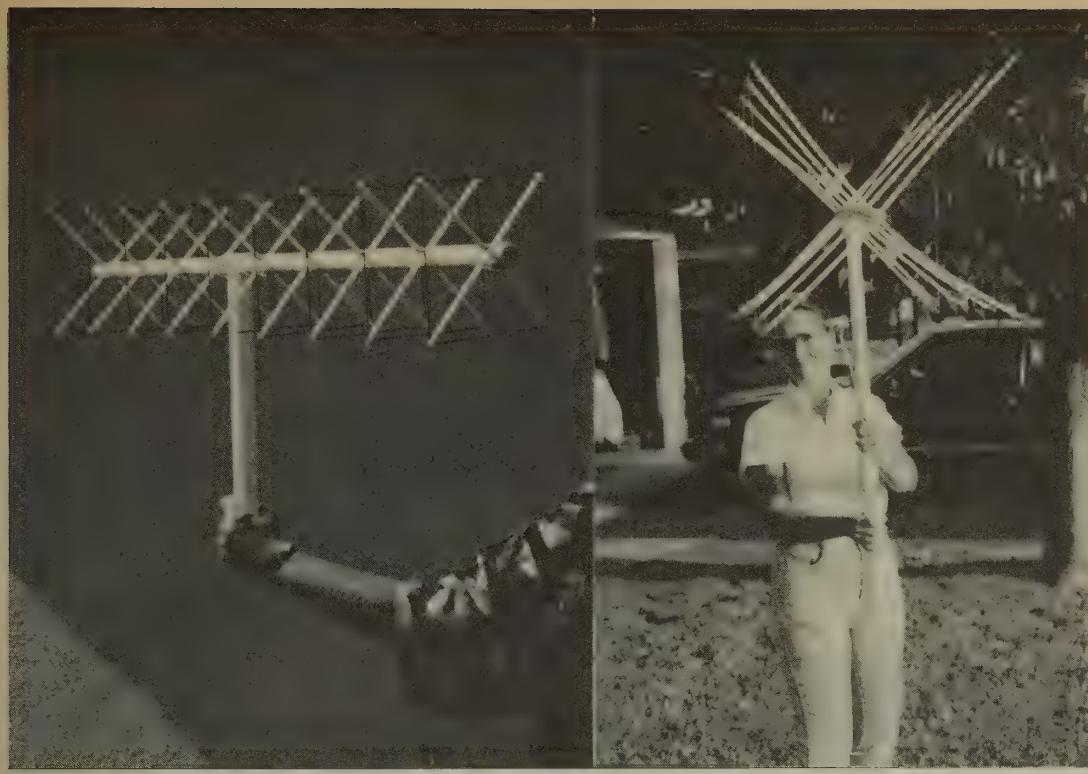


Photo B. The 2 meter quad (right) is larger than the 440 MHz quad (left).



Photo C. Watch the LCD bar graph (below the frequency readout) for the signal strength readout as you rotate the yagi or quad antenna.

**N**ULL. Go horizontal, and the signal strength should be a lot lower, and you might be able to see a NULL on your LCD signal-strength meter.

Next, go inside your house and see what happens to your antenna's DIRECTIVITY. Yikes—you move it all around, and it doesn't seem to be directive at all. What's going

on? REFLECTIONS from the house wiring, aluminum siding and other metal throughout your house are probably causing the signal to be reflected in many directions. This is why you must be IN THE CLEAR to take accurate heading directions.

If you have a 440 MHz handheld, try picking up a reflected signal off

of a passing jet. When you hear a rapid flutter, this is signal reflection at its best. Occasionally, the reflected signal with its rapid flutter may even be stronger than the direct signal!

You can use the quad to track down interference from home electronics on the 2 meter or 440 MHz band. Interference is usually the sound of a "dead carrier" right on your favorite repeater channel, and the only time you hear it is when you bring your handheld into the house. Chances are you can track down the "dead carrier" to a tiny emission from a telephone answering device, FAX machine, personal computer, or even those ultrasonic flea repellers that plug into the wall. Your little quad will turn you into a real detective.

So do consider the quad an educational antenna as well as a practical one. What you can learn from a small 2 meter or 440 MHz quad will apply to all the things you may need to know when you start putting up that big five-element triband beam antenna on an 80-foot tower. The small quad is quite educational!

RF

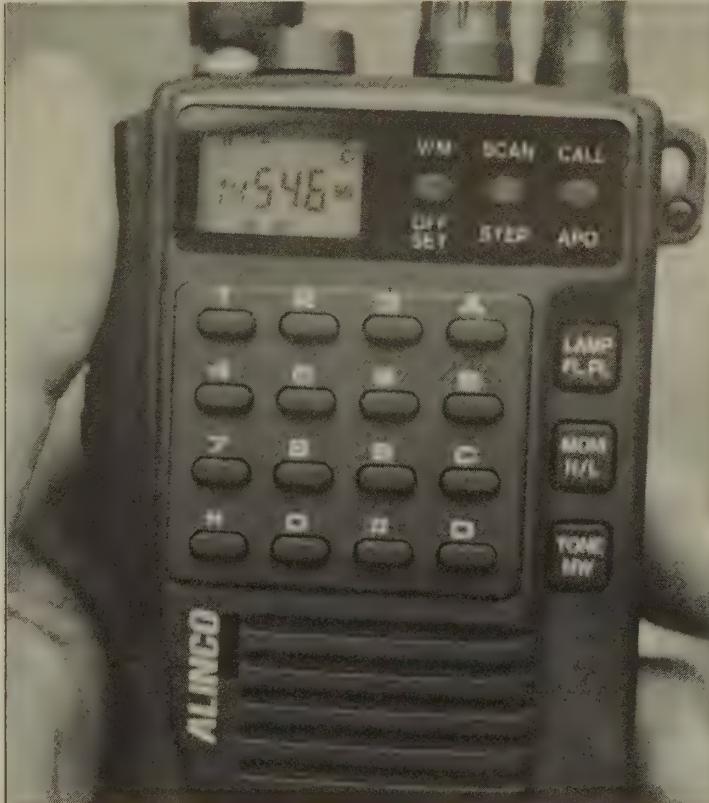


Photo D. You will *hear* the difference on your handheld when you rotate any loop or yagi off of the main incoming signal.

# Maxcom

OVER 7,000 MAXCOM® STATIONS WORLDWIDE  
THE BOTTOM LINE: "MAXCOM® WORKS".

*"The ONLY, Absolutely, Completely, Fully, No Adjustment, Install It, Forget It, Works Even in Receive, All Frequency, Tougher than Lightning, Works Forever, Waterproof, Automatic Antenna Matcher"!!!*

P.O. Box 502  
Fort Lauderdale • Florida 33302  
Phone: 305-523-6369 • Fax: 305-522-8159



CIRCLE 101 ON READER SERVICE CARD

## QUICK, EASY, & COMPACT

Flash cards \* NOVICE thru EXTRA \* theory Key words underlined. Over 4000 sets in use! For beginner, OMs, XYLs & kids.

NOVICE	\$11.95
TECHNICIAN	\$10.95
GENERAL	\$ 9.95
ADVANCED	\$15.95
EXTRA	\$14.45
Shipping	1-\$ 3.00 2 or more -\$ 4.00
CLUB DISCOUNTS	

Order Today!  
from

VIS STUDY CARDS  
P.O. BOX 16646  
HATTIESBURG, MS 39404

CIRCLE 104 ON READER SERVICE CARD

AEA  
ASTRON  
BENCHER  
BUTTERNUT  
CALLBOOK  
COMET  
DIAMOND  
HUSTLER  
KANTRONICS  
LARSEN  
ANTENNA  
MFJ  
RADIO SHACK  
SMILEY  
ANTENNAS  
VALOR  
ANTENNAS  
& more.

Small town  
service with  
discount prices.

**DANDYS**

120 N. Washington  
Wellington, KS 67152  
(316) 326-6314

CIRCLE 130 ON READER SERVICE CARD

# Kitt Peak Radio Observatory

*Seeing the world with the shortest radio waves.*

by Roald Steen AJØN/LA6US

Millimeter radio waves are at the shortest end of the radio bands. The Kitt Peak Radio Observatory in Arizona was the first radio telescope constructed to look at the universe at millimeter wavelengths.

Kitt Peak was selected for this observatory because of its elevation—around 6,000 feet. Millimeter radio waves are attenuated during their travel through the atmosphere. This attenuation is reduced at a mountain site like Kitt Peak.

Also, much of the atmospheric attenuation of millimeter radio waves is caused by water vapor in the atmosphere. The atmosphere at the Kitt Peak site is relatively dry so water vapor attenuation is maintained at a low level.

Kitt Peak is operated by the National Radio Astronomy Observatory. This organization also operates the Very Large Array, composed of 27 individual antennas, in New Mexico, and the radio observatories at Green Bank in West Virginia.

## The Reflector

The diameter of the Kitt Peak reflector antenna is 40 feet. Most radio observatories are bigger; however, a radio observatory must have a reflector which is very smooth compared with the wavelength it is observing. A radio observatory working at longer wavelengths can easily be made bigger, but it was a challenge to build a 40-foot disk with the smoothness that is required for

millimeter wavelength observations.

The resolving power of a radio telescope is proportional to the size of the observatory and the wavelength at which it is observing. Since the millimeter waves are so short, the Kitt Peak Radio Observatory can resolve distant objects better than many larger radio observatories operating at longer wavelengths.

The Kitt Peak Radio Observatory was built in 1967. Its reflector surface was then 36 feet in diameter. A later improvement resulted in the present 40-foot antenna. The new reflector antenna was built from materials that have similar thermal coefficients of expansion. This is important because metals with different coefficients of expansion could cause the reflector to become somewhat distorted during changing temperatures.

The Kitt Peak Radio Observatory is built in the so-called Cassegrain Configuration. A radio telescope with this configuration has a subreflector which receives the radio waves from the main reflector and directs these radio waves towards receiving equipment located at the center of the main reflecting disk. The Cassegrain Configuration is the most practical configuration for many radio observatories because it is difficult to support the heavy receiving equipment in a stable manner at the focus of the main reflector.

All electronic components develop some internal noise when they

are working in a circuit. Most of the internal noise is caused by thermal noise in the materials from which the components are made. At room temperature, this thermally-produced noise would overwhelm most of the weak signals that are being received from space. The receiving equipment at the Kitt Peak Observatory is therefore cooled with liquid helium. Liquid helium as a coolant maintains a temperature of only a few degrees above absolute zero.

The movement of the observatory towards objects in the sky is under computer control. The objects must be tracked as they move across the sky due to the rotation of the earth, and this function is also controlled by the computers.

Waveguides are used to conduct the signals which the Kitt Peak Radio Observatory picks up from space to the control building, where the signals are processed by powerful computers. The output from the computers can be in the form of color images, almost as if one were observing the sky with radio eyes. In these color images, different colors indicate different intensities or frequencies in the received radio signals.

The signals can also be transformed into graphs and statistics. Much of the information is recorded on magnetic tape so that scientists can study the information after the observations have been completed.

The water vapor content over Kitt Peak varies throughout the year. It is highest during the summer, so the summer months are usually used for maintenance, calibration and testing of the observatory.

The moon and the planets are conspicuous objects at millimeter radio wavelengths. The Kitt Peak Radio Observatory has been used to map the millimeter radio waves that these objects emit.

The spiral structure of nearby galaxies has been mapped at mil-



Photo B. The Kitt Peak Radio Observatory, seen from the air.

limeter wavelengths by the observatory. Galaxies that are conspicuous at other wavelengths, such as the galaxies that emit radio jets, are also prominent at millimeter wavelengths.

Many molecules have, in recent years, been found in space between the stars in our galaxy. Most of these molecules have been discovered due to their millimeter wave radiation. The Kitt Peak Radio Observatory has been prominent in detecting and mapping millimeter radio waves from molecules in interstellar space.

Optical astronomy also benefits from the dryness and low atmospheric

attenuation at Kitt Peak so there are also several optic telescopes near the Kitt Peak Observatory.

The Kitt Peak National Observatory, which operates the optical telescopes at this site, includes a visitors' center on the mountaintop. The site can be reached by car. An exhibit at the visitors' center is devoted to the Kitt Peak Radio Observatory. This exhibit shows how the radio telescope is constructed and the principles behind its operation. The exhibit also includes a presentation on the research which is conducted at the Kitt Peak Radio Observatory.

RF

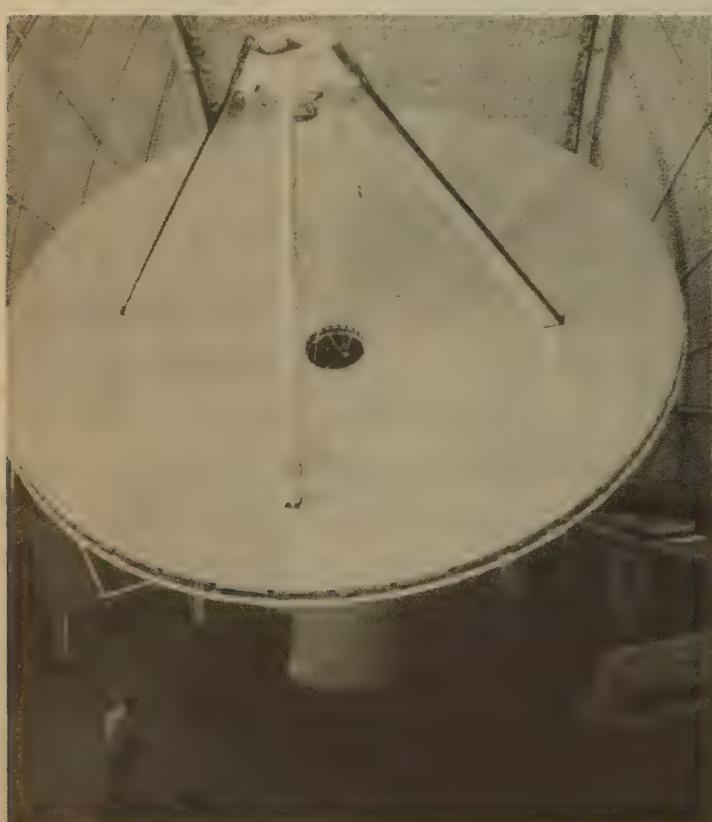


Photo A. The 40-foot parabolic reflector of the Kitt Peak Radio Observatory. A subreflector in front of the parabola directs the signals from space towards receiving equipment at the center of the parabola.



Photo C. The control room.

# UNADILLA ANTENNA MANUFACTURING CO.

(508)  
474-8949  
24 Hour FAX

THE BIG™  
SIGNAL  
Amateur Antenna Baluns

For over 20 years, preferred by Amateur, Military and Commercial Operators. Assembled with all stainless steel hardware and a built-in lightning arrester minimizes your TVI, maximizes your power.

(508)  
475-7831  
9-5 EST M-F

W2AU  
(1:1 & 4:1)

## Transformer Baluns

For medium power (1000 watts RF minimum) and broadband operation 3-40 MHz.

**W2AU 1:1**

50/50 or 75/75Ω  
Dipoles, V's  
Beam Models, Quads

**W2AU 4:1**

200/50 or 300/75Ω  
Hi-Impedance Antennas  
(ie: Folded Dipoles)

## Non-Transformer Baluns

**W2DU-HF**

1.8-30 MHz  
3000-9000W  
1500-5000W



w/1:1 SWR  
w/2:1 SWR

**W2DU-VHF**

30-300 MHz  
2000-4000W  
1200-2400W

### Contact Your Local Ham Dealer Today!!!

To order direct call (508) 475-7831 or write  
for our informational brochure on our other fine products  
Baluns•Antenna Kits•Filters•Center Insulators•ENDsulators™•Coaxial Relays  
All products come with a 30 Day Warranty

#### -NOTICE-

We are the NEW manufacturers of the original  
**JAMES MILLEN™** Products  
(508) 975-2711 9am-5pm EST M-F

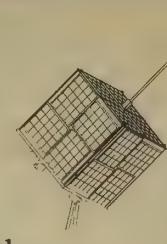
CIRCLE 136 ON READER SERVICE CARD



# AMSAT

## Dedicated to Keeping Amateur Radio in Space!

**AMSAT**—The Radio Amateur Satellite Corporation is an organization of Radio Amateurs who design, build and launch satellites for use by Radio Amateurs around the world.



Your new Amateur Radio License will be your ticket to a whole world of exciting opportunities. Why not expand your horizons even further by becoming a member of AMSAT and participating in space aged Amateur Radio?

## Join the Excitement! Join the Fun! Join AMSAT!

Yearly Membership dues: \$30 U.S., \$36 Canada/Mexico, \$45 Elsewhere JOIN NOW!

Name \_\_\_\_\_ Call \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

\$15 of membership dues  
goes toward a subscription  
to *The AMSAT Journal*

Post Office Box 27, Washington, DC 20044

Telephone 301-589-6062

Fax 301-608-3410

CIRCLE 110 ON READER SERVICE CARD

# RAMSEY ELECTRONICS

## FANTASTIC FM TRANSCEIVER KITS!

2 meters • 223 MHz • 440 MHz  
only \$149.95!

\$169.95 for 440 MHz

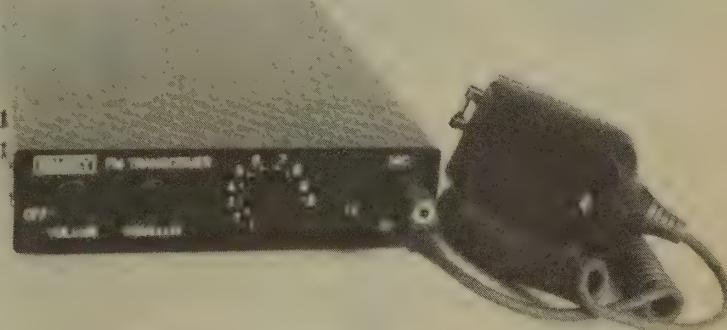
### Fully Synthesized - No Crystals

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable, mobile or a dedicated packet rig. Wide frequency coverage (20 MHz) and programmable repeater splits makes the FX the perfect rig for CAP, MARS or business band snooping. Packeteers really appreciate the built-in packet I/O connector, true FM signal, instant T/R switching and 9600 baud capability. You get twelve channels - easily diode programmed anywhere you want, 5 watts RF output (3-4 for FX-440), sensitive dual conversion receiver with crystal and 6 pole ceramic IF filters, plus proven easy assembly.

You build your FX in stages of a few parts at a time, logically working your way along through each section, testing your work as you build. The only test equipment you'll need is a voltmeter and another

radio or frequency counter. Our 120 page instruction manual will carefully guide you to a finished unit that will work first time - and you'll learn, too! Why pay more for a used foreign-made rig when you can have an AMERICAN MADE one (by you) for less? Kit comes complete with all parts, quality epoxy PC board with printed parts layout, and extensive manual. You only need to add an ICOM/Radio Shack/Yaesu style mike and suitable enclosure. The Ramsey matching case set includes all hardware, knobs and rugged steel case (weighs 3 lbs!), with durable black powder coat finish.

Building your own rig, isn't that what ham radio is all about? Is ham radio simply buying a foreign rig we just unpack and plug-in? Let's stop sending our dollars overseas, start building, learning, experimenting and regain our technological edge.



## PHONE ORDERS CALL

716-924-4560

FAX 716-924-4555

FX-146 (2 meters)

\$149.95

Still not sold? Order our FX manual and see

FX-223 (1 1/4 meters)

\$149.95

for yourself! Only \$10.00, refundable with

FX-440 (70 cm)

\$169.95

purchase of transceiver kit.

CFX matching case set \$ 24.95

FX manual, specify band desired - \$10.00

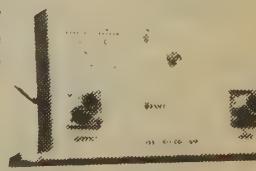
## 2 METER & 220 BOOSTER AMP

### BOOST THE OUTPUT OF YOUR 2 METER OR 220 MHZ HT OR RAMSEY TRANSCEIVER FOR A LOT LESS THAN THOSE HIGH-PRICED AMPS!

These power boosters deliver over 30 watts of output, while a low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of these units. Get the features of those high-priced boosters at a fraction of the cost!

PA-10 2 meter, prewired (10x power gain) - \$89.95

PA-20 220 MHz, prewired (8x power gain) - \$89.95



## PHONE ORDERS CALL

716-924-4560 FAX 716-924-4555

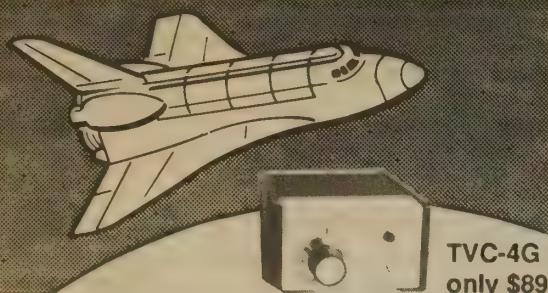


YOUR SATISFACTION IS GUARANTEED. Examine your Ramsey product for 10 days. If you're not pleased, return in original condition for refund. Add \$3.75 for shipping handling and insurance. Foreign orders add 20% for surface mail. COD (US only) add \$5.00. Orders under \$20.00 add \$3.00. NY residents add 7% sales tax. Warranty: 90 days on kit parts; 1 year parts and labor on pre-wired units.

RAMSEY ELECTRONICS, INC • 793 Canning Parkway • Victor, NY • 14565

CIRCLE 34 ON READER SERVICE CARD

# AMATEUR TELEVISION



## SEE THE SPACE SHUTTLE VIDEO

Many ATV repeaters and individuals are retransmitting Space Shuttle Video & Audio from their TVRO's tuned to Satcom F2-R transponder 13. Others may be retransmitting weather radar during significant storms. If it is being done in your area on 70 CM - check page 413 in the 91-92 ARRL Repeater Directory or call us, ATV repeaters are springing up all over - all you need is one of the TVC-4G ATV 420-450 MHz downconverters, add any TV set to ch 2, 3 or 4 and a 70 CM antenna. We also have downconverters and antennas for the 900 and 1200 MHz amateur bands. In fact we are your one stop for all your ATV needs and info. Hams, call for our complete ATV catalog - antennas, transceivers, amplifiers. We ship most items within 24 hours after you call.

(818) 447-4565 m-f 8am-5:30pm pst.

Visa, MC, COD

P.C. ELECTRONICS

2522-WG Paxson Ln Arcadia CA 91007

Tom (W6ORG)

Maryann (WB6YSS)



## Transceiver Control Computer Interface

Control Kenwood, Icom, Yaesu, and other transceivers. The low power microminiature electronics is built into the DB-25 connector. Power is borrowed from the computer, so there is no power supply to pick up RFI. No assembly required. Compatible with Ham Windows, CT, DXBase, LOGIC, and all other rig control software. Specify your transceiver make and model number: we will wire the correct connector for you. Cable and RC-Plus software: \$54.95 (\$5 s/h)

## Make and Receive Phone Calls on your own Personal Autopatch!



Use any phone line and an HT or base station to make phone calls from your car. Full duplex (both parties can talk at the same time) or simplex (VOX with turn-around beeps). Programmable local and long distance access codes. Regenerated DTMF / Pulse dialing. Automatic CW identification. 1.5" x 4.6" x 5.1" D RF shielded metal enclosure. Autopatch \$199.95 (\$5 s/h) 12V adapter \$11.95

Foreign Orders add \$10.

CA orders add Sales Tax.

Money back guarantee.

J-Com • Box 194-T • Ben Lomond CA 95005  
(408) 335-9120 FAX 335-9121

CIRCLE 55 ON READER SERVICE CARD

# activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

FEB 2

ROANOKE, VA VE Exams will be held by the WCARS for upgrades only, at Hollins College at 8 PM. Pre-registration only. Contact Fred L. Horton KZ4Y, (703) 366-6266, or Ben Giavaden N4BG, Route 7, Roanoke VA 24022.

FEB 6

HAMPTON ROADS, VA Sign up for Hampton Roads Radio Assn's W5YI Exams. Please contact Bill Runyon on N4BDH, (802) 487-8611, or details.

KNOXVILLE, TN WCARS VEC Exams, for upgrades only, will be held in Room B-129 at Pellissippi State Tech. Comm. College, Pellissippi Campus, at 10 AM, 10:20 AM, and 10:40 AM. Written elements at 11 AM. Please pre-register. Contact Ray Adams N4BAQ, (615) 688-7771, or Rich Slover ND4F, (615) 539-4821.

PARIS, TN Henry County H.S. will be the location for WCARS VEC Exams at 9 AM. Call Mackie Gallimore A44YF, (901) 247-5489, or Les Merrell KQ4F, (901) 642-5966.

ST. CATHARINES, ONT., CANADA The Niagara Peninsula ARC Inc. will hold a Hamfest and Dinner-dance at the C.A.W. Hall, 124 Bunting Rd. Talk-in on 147.24/84. Dinner-dance tickets by advance only. For info, please write N.P.A.R.C. Inc., P.O. Box 692, St. Catharines, Ont. L2R 6Y3, Canada. Tel. (416) 934-3231, or VE3KLM@VE3SNP.

FEB 8

MARYVILLE, TN WCARS VEC Exams will begin at 7 PM at St. Andrews Church Hall, W. Broadway. Contact Carroll Peabody W4PCA, (615) 982-5839 for details.

FEB 13

GOSHEN, NY The Orange County ARC Computer Fair/Winter Hamfest will be held at John S. Burke Catholic H.S. on Fletcher St. Talk-in on 146.760-600, plus 100 Hz tone. For more info, call Jim Capicotto, (914) 564-2707.

MARION, NC VEC Exams by WCARS will be held at Asheville Federal Bank Bldg., Main St. Contact Cecil D. Potter WB4UCF, (704) 724-4007.

WEST MEMPHIS, AK WCARS VEC Exams will be held at 9 AM at Rosewood United Methodist Church, 2303 E. Barton Ave. Get details from Gene Bagley AB5BL, (501) 739-4029 or Rev. Richard Gregory AB5CH, (501) 735-4060.

FEB 14

JASPER, TN WCARS VEC Exams will be held (by pre-registration only) at 1 PM at Jasper Public Library. Contact Charles Wooten KD4XX, (615) 942-5116, or Wallace S. Brown KD4KV, (615) 942-2836.

MANSFIELD, OH The Mansfield Mid\*Winter Hamfest/Computer Show will start at 7 AM at the Richland City Fairgrounds. Advanced Ticket/Table Orders must be received and paid by Feb. 1st, 1993. Talk-in on W8WE 146.349/94 rptr. Contact Dean Wrasse KB8MG, 1094 Beal Rd., Mansfield OH 44905. Tel. (419) 589-2415 after 4 PM EST.

FEB 20

CHARLESTON, SC The Charleston ARS, Inc. will hold their Hamfest in the Geodesic Dome at Charles Town Landing, 1500 Old Town Plantation Rd., from 8:30 AM-4 PM. Talk-in on 146.19/79, 144.65/145.25, and 147.87/27 MHz. Walk-in VE Exams will be given on the campus of Trident Tech. College at 11 AM. For exam info, call (803) 871-4368 or (803) 572-1164. For Hamfest details, call Jenny Myers, (803) 247-2324, or Linwood Sikes, (803) 556-5566.

COLUMBIA, SC The Red Cross Bldg., Bull St., will be the location for WCARS VEC Exams at 8:30 AM. Get details from Ray Rogers N4WR, (803) 345-3373. NEW ALBANY, IN WCARS VE Exams will be held in Room 204, Knob View Bldg., Indiana U. South, Grant Line Rd., from 10 AM-2 PM. Contact Dick Truax K8GVU, (812) 246-6377, or "Mac" McCrory NM9A, (812) 944-6661.

SALEM, OR The Salem and Oregon Coast Emergency Repeater Assns. will sponsor their 1993 Ham Fair at the Polk Cty. Fairgrounds, beginning at 9 AM. Talk-in on 146.26/86. For more info, write to: Salem Repeater Assoc., P.O. Box 784, Salem OR 97308.

FEB 21

ASHEVILLE, NC WCARS VE Exams will take place AB Tech Room 134, Elm Bldg., at 2 PM. Get details from Harry Dull AA2AB, (704) 891-5481 or Don Lovelace W4MT, (704) 765-5311.

DEARBORN, MI The Dearborn Civic Center will be the location for the Annual Swan 'N Shop sponsored by the Livonia ARC. Doors open from 8 AM-4 PM. VE Exams in the afternoon. Talk-in on 144.75/145.35 and 146.52 simplex. For more info, send 4 x 9 SASE to Neil Coffin WA8GWL, Livonia ARC, P.O. Box 2111, Livonia MI 48151. Tel. (313) 427-3905.

NEW HYDE PARK, NY A Hamfest, sponsored by the Long Island Mobile ARC, will be held from 9 AM-4 PM at the Nassau County Police Activity League, 375 Denton Ave. Talk-in on 146.25/85. For further info, please contact Neil Hartman WE2V, (516) 462-5549.

ROCK ISLAND, IL The 22nd annual Davenport (Iowa) ARC Hamfest will be held at the QCCA Expo Center. Large indoor Flea Market. Talk-in on the WOBXR 146.28/88 rptr. Advance payment deadline is Feb. 15th.

Contact Al Broendel N9OK, 2712 38th St., Rock Island IL 61201, for Exam details; or Talk-in on the WOBXR 146.04/64 rptr. For Hamfest info, contact Kent Williams K9UQI, 4245 10th St., East Moline IL 61244.

FEB 27

DALTON, GA WCARS VE Exams will be held at 3 PM at Unity Baptist Church, Burleson Rd. No walk-ins. Contact Bert L. Coker N4BZJ, (706) 239-5625 or Harold W. Jones N4OTC, (706) 673-2291.

FEB 28

CINCINNATI, OH The ARRL 1993 Great Lakes Div. Convention will be held from 8:30 AM-5 PM (both days) at the Cincinnati Gardens Exhibition Center, Seymour Ave. and Langdon Farm Rd. Advance deadline is Feb. 17th. Contact Stan Cohen WD8QDQ, (513) 531-1011, or Joe Halpin W&JDU, (513) 851-1056.

MAR 6

ABECON, NJ The Shore Points ARC will sponsor "Springfest '93" at Holy Spirit H.S. on Route 9. Doors open at 9 AM. Talk-in on 146.385/985. For more info, write to: SPARC, P.O. Box 142, Absecon NJ 08201.

MAR 7

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC 39th Annual Hamfest will be held at the St. V. Center, 3479 State Rd., from 7 AM-3 PM. Talk-in on 87/27. Get details from Bill Sovinsky K&SL, 2305 24th St., Cuyahoga Falls OH 44223. Tel. (216) 923-3830.

NORTHAMPTON, MA A Hamfest will be held at Smith Voc. School, Rte 9, by the Mt. Tom ARA, beginning at 9 AM. VE Exams at 10 AM. Pre-register by calling (413) 245-3228. Talk-in on 146.34/94. Get details from Jim KIMEA, 316 Main St., Easthampton MA 01027. Tel. (413) 527-3199, 7-9 PM.

MAR 13

FARGO, ND Hamfest '93, from 8 AM-3 PM, will be sponsored by Red River Radio Amateurs at The Bowler, 2630 S. Univ. Dr. Talk-in on 146.16/76. Ask about Banquet tickets. Contact RRRA, P.O. Box 3215, Fargo ND 58108-3215. Tel. (218) 233-2584 7 PM-10 PM.

## SPECIAL EVENT STATIONS

FEB 6-7

NORTH CENTRAL, WI A group of hams will operate KF9MG on 28.360, 21.360, 7.260 and 38.860, to commemorate the 1993 Badger State Winter Games. For certificate, send QSL and large SASE to Mike KA9VFP, 1104 E. Lieg Ave., Shawano WI 54166.

FEB 13-14

CONCORD, NH The Contoocook Valley RC will celebrate the Grand Opening of the K1BKE Club station, at the Christa McAuliffe Planetarium during the New Hampshire QSO Party. Tune in on the 80-10 meter bands. For QSL, send a #10 SASE to Contoocook Valley RC, P.O. Box 88, Henniker NH 03242.

FEB 13-15

1993 NEW HAMPSHIRE QSO PARTY The NH ARA will sponsor this event from 1900 UTC Feb. 13th-0700 UTC Feb. 14th, and from 1400 UTC Feb. 14th-0200 UTC Feb. 15th. Open to all license classes. For more details, write to G.E.A.R.S., Conrad Ekstrom WB1GXM, P.O. Box 1076, Claremont NH 03743-1076.

FEB 19-21

MARQUETTE, MI The Hiawatha ARA will operate N8GBA from 1700Z Feb. 19th-1700Z Feb. 21st, to honor the UP 200 Sled Dog Championship. Use the lower end of the 10, 15, 20 and 40 meter phone bands. For a certificate, send a large SASE (with 2 stamps), to Richard Schwenke N8GBA, 21 Smith Ln., Marquette MI 49855.

FEB 20

BREMERTON, WA The North Kitsap ARC of Washington, will operate K75XL at the Olympic College in conjunction with VoTech Week. Operating hours are from 1600Z to 2400Z. Frequencies: CW—3.65/69, 7.04/88, 14.04/88, 21.04/88, 28.025/075 MHz; SSB—3.84/88, 7.24/88, 14.24/88, 21.34/38, 28.44/48 MHz. Send QSL with SASE to North Kitsap ARC, P.O. Box 2268, Silverdale WA 98383-2268.

FEB 25-28

BROWNSVILLE, TX The Faulk Intermediate School ARC will operate NSSMH from 1400Z-2200Z, to commemorate the annual Charo Days Festival. Tune the General portion of 40, 20, 15, and Novice portion of the 10 meter bands. For Certificate, please send a QSL and SASE to Faulk Intermediate ARC, 2200 Roosevelt, Brownsville TX 78521.

FEB 27-MAR 2

HUNTSVILLE, TX The Huntsville ARS will operate WASSM from the campus of Sam Houston State U., from 0000Z Feb. 27th-2400Z Mar. 2nd, during the celebration of General Sam Houston's 200th birthday. Frequencies: Lower portion of the HF General phone subbands, and the Novice 10m phone subband. For a 3-color Certificate, send QSL and a 9 x 12 SASE; for a QSL card, send QSL and SASE, to HARS Special Event, P.O. Box 7516, Huntsville TX 77342-7516.

## SELL YOUR USED GEAR IN THE RADIO FUN FLEA MARKET

## RADIO FUN FLEA MARKET

## CALL JUDY WALKER TODAY

1-800-274-7373

**ELENCO & HITACHI & B+K PRODUCTS AT DISCOUNT PRICES**

**ELENCO OSCILLOSCOPES**

2120 - 20MHz Dual Trace	\$395
2125 - 20MHz Delayed Sweep	\$539
1541B - 40MHz Dual Trace	\$749
2160 - 60MHz Dual Trace, Delayed Sweep, Dual Time Base	\$949
2190 - 100MHz Three Trace Dual Time Base, Delayed Sweep	\$1,395
2522 - 20MHz / 10MS/s Storage	\$895
1442 - 20MHz Portable	\$1,229
1443 - 40MHz Battery / AC operated with Cursor & Readouts	\$1,439

**S-1325 25MHz \$349**  
Dual Trace Oscilloscope

**S-1340 40MHz \$495**  
Dual Trace Oscilloscope

**S-1360 60MHz Dual Trace, Delayed Sweep \$775**  
Automatic beam finder, Built-in component tester, 1mV sensitivity, Dual time base

**Digital Capacitance Meter CM-150B \$58.95**  
9 ranges, 5% basic accy, Zero control w/ Case, Big 1" display

**Digital LCR Meter LC-1801 \$125**  
Measures Cols 1-100,000, Caps 1pF-200uF, Res 0.1-20M

**Multimeter with Capacitance & Transistor Tester \$55 CM-1500B**  
Reads Volts, Ohms, Current, Capacitors, Transistors and Diodes / with case

**1.0GHz PORTABLE SPECTRUM ANALYZER Model 2610 \$2,595.00**

**Hitachi Compact Series Scopes**

V-212 - 20MHz Dual Trace	\$409
V-525 - 50MHz Cursors	\$975
V-522 - 50MHz, DC Offset	\$849
V-422 - 40MHz, DC Offset	\$749
V-660 - 60MHz, Dual Trace	\$1,095
V-655A - 60MHz, DT, w/cursor	\$1,325
V-1060 - 100MHz, Dual Trace	\$1,375
V-1065A - 100MHz, DT, w/cursor	\$1,649
V-1085 - 100MHz, QT, w/cursor	\$1,995
V-1100A - 100MHz, Quad Trace	\$2,195
V-1150 - 150MHz, Quad Trace	\$2,695

**Hitachi RSO Series**

RSO's feature: roll mode, averaging, save memory, smoothing, interpolation, pretriggering, cursor measurements.

VC-6023 - 20MHz, 20MS/s	\$1,650
VC-6024 - 50MHz, 20MS/s	\$2,350
VC-6025A - 50MHz, 20MS/s	\$2,350
VC-6045A - 100MHz, 40MS/s	Call
VC-6145 - 100MHz, 100MS/s	Call

**FLUKE MULTIMETERS (All Models Available Call)**

Model 33	\$1,225.00
Model 95	\$1,549.00
Model 57	\$1,795.00
10 Series	\$1,995.00
Model 10	\$62.95
Model 12	\$79.95
	\$289.00

**Scopemeters**

Model 73	\$1,225.00
Model 70II	\$65.00
Model 77II	\$145.00
Model 79II	\$169.00
Model 80 Series	Call

**True RMS 4 1/2 Digit Multimeter**

Model 33	\$1,225.00
Model 70 Series	\$1,650
Model 77II	\$145.00
Model 79II	\$169.00
Model 80 Series	\$289.00

**FLUKE MULTIMETERS (All Models Available Call)**

Model 33	\$1,225.00
Model 95	\$1,549.00
Model 57	\$1,795.00
10 Series	\$1,995.00
Model 10	\$62.95
Model 12	\$79.95
	\$289.00

**True RMS 4 1/2 Digit Multimeter**

Model 33	\$1,225.00
Model 70 Series	\$1,650
Model 77II	\$145.00
Model 79II	\$169.00
Model 80 Series	\$289.00

**True RMS Accuracy 0.05% Resistance with Freq. Counter Data Hold**

**AM/FM Transistor Radio Kit with Training Course**

**XP-620 Assembled \$75**  
Kit \$50  
2 to 15V @ 1A  
-2 to -15V @ 1A  
(or 4 to 30V @ 1A)  
and 5V @ 3A

**Triple Power Supply XP-620 Assembled \$75**  
Provides sine, triangle, square wave from 1Hz to 10MHz  
AM or FM capability

**Quad Power Supply XP-580 \$69.95**  
2-20V @ 2A  
12V @ 1A  
5V @ 3A  
-5V @ 5A  
Fully regulated and short circuit protected

**Function Generator Blox #9600 \$28.95**  
Provides sine, triangle, square wave from 1Hz to 10MHz  
AM or FM capability

**AM/FM Transistor Radio Kit with Training Course**

**XP-620 Assembled \$75**  
Provides sine, triangle, square wave from 1Hz to 10MHz  
AM or FM capability

**14 Transistors + 5 Diodes \$27.95**  
Makes a great school project

**14 Transistors + 5 Diodes \$27.95**  
Makes a great school project

**1K500 Digital / Analog Trainer**

A complete mini-lab for building, testing, prototyping analog and digital circuits. Elenco's Digital/Analog Trainer is specially designed for school projects, with 5 built-in power supplies. Includes a function generator with continuously variable sine, square, triangle, square wave forms. All power supplies are regulated and protected against shorts.

**Power Supplies**

- Variable Power Supply
- 1.25 to 15VDC @ 1A
- 1.25 to 15VDC @ 3 Amp
- 1.25 to 15VDC @ 5 Amp
- 1.25 to 15VDC @ 8 Amp
- 1.25 to 15VDC @ 10 Amp
- 12VDC @ 1A
- 5VDC @ 1 Amp
- 3.0VDC @ 1 Amp
-

# radio magic

Continued from page 14

## Direct Digital Synthesizer

Another feature to look for in your new radio is DDS, or a Direct Digital Synthesizer. A Direct Digital Synthesizer allows very fine tuning rates, usually down to 1 Hz. This slow tuning rate is needed when operating digital modes such as HF packet or AMTOR. The December 1992 and January 1993 issues of *73 Amateur Radio Today* describe a simple Direct Digital Synthesizer rig for QRP use. Check it out!

So, the choice is yours. Only you know what you can afford and only you can say for sure what kind of rig you want. There's more to ham radio than just CW and SSB, so look over the options of using digital communications. This may include full QSK (full break-in) to special "digital mode" filters. Are you a member of MARS or thinking of becoming a member down the road? If so, then look for a rig that will allow operation out of the normal ham bands. You may have to do a simple modification yourself to the rig or pay to have it done. Just be sure the rig will work out of band for MARS and CAP use.

How about getting the rig repaired when it breaks? Most of the solid-state microprocessor rigs are beyond most of us to fix ourselves. The use of surface-mount components and special ICs leave little to be fixed by most hams. Keep this in mind when going for the best price. It might be cheaper in the long run to pay a little bit more for the rig from a dealer who will repair it in-house than to send it across the country to a national repair depot. Gordon West WB6NOA did a very complete service survey on the major radio manufacturers in *73 Amateur Radio Today* a year or so ago.

No one radio is better than another; the difference is mostly in features you like and how they are used. Personally, I like Ten-Tec rigs. Always did, always will. They're easy to fix if they get sick, and if I'm in a spot with one a call down to the factory will usually solve the problem. Many times a board swap at no charge will fix the problem with a Ten-Tec rig. Ten-Tec's QSK is the standard which others are compared to. It's a CW op's dream rig.

Many of my friends contest and contest very heavily. They prefer the Kenwood models. Ease of use and operating performance, as well as style, make Kenwood a very popular choice. Kenwood has a service manual for all their rigs to help in their repair.

If you chase DX and read about DXpeditions, then you know all too well ICOM has many choices to choose from. I find ICOM rigs a bit easier to repair and get parts for than some of the other ones. ICOM has a very, very intensive line of accessories for all of their rigs.

But when I think of working SSB, my thoughts go back to the time I helped operate the World Wide DX contest and I operated a Yaesu FT-101ZD. Smooth, clean operation with an audio punch that put QSOs in the logbook. Yaesu also makes the only (that I know of) 2 meter rig to meet Mil specs!

I hope some of this will help you in picking out a new rig. Sometimes the best thing to do is ask a friend who has one if you can spin the knobs. Don't let one bad report sour your thinking. There's going to be a bad apple in everyone's basket at some time. Keep an open mind when asking around. **RF**

## Operation Holidays II

Continued from page 1

handlers' skills at optimum levels—skills that are developed for use in times of public emergency or disaster.

You, the amateur, and your radio club have an obligation to the public which is served by amateur radio. Only an informed public, using the services available to them, will know that amateur radio is an important service. Only an informed public can help to protect the amateur bands from being

usurped by other potential users. Only an informed public can make legislators and regulators see the value of amateur radio as a national asset.

Only you, the amateur community, can get the word out to the public. Act now! Talk to your family, your friends, your neighbors, your civic leaders. Write letters to editors. Submit new items. GET INVOLVED. The future of amateur radio may well be in your hands. **RF**

## Youth Forum Interviewees Needed

Carole Perry WB2MGP is seeking articulate, active amateur radio youngsters up to age 18 to be interviewed for various youth

forums across the country. Please contact Carole at P.O. Box 131646, Staten Island NY 10313-0006, or call her at (718) 983-1416.

## The Best Scanner Use Antenna!

The FLYTECRAFT™ Model CFN  
16 Element Wideband VHF/UHF Antenna



Designed by  
Emmy-Winning  
Network TV Engineer  
Steve Flyte,  
K7SF

- The Model CFN is the ultimate compact, rugged antenna for 50 to 1.3 GHz use. (Transmit from 144 to 1.3 GHz)
- Average SWR - 1.5 across transmit range.
- Amateur radio licensees operate all bands - 2M, 220, 450, 900, and 1.2 GHz.
- Novices! Ideal for operation in 220 or 1.2 GHz band for which you have privileges.
- Large vertical angle radiation
- Unity gain
- Use indoors or out - CFN is lightweight, but tough - withstands hurricane-force winds.
- Instant assembly - ideal for permanent, portable, or Field Day!
- Attractive, strong design. Unique, futuristic appearance.

Built with pride & sold worldwide - FLYTECRAFT™ USA

FLYTECRAFT™ Model CFN ~ \$119.95

Send Check or \$ Order to: FLYTECRAFT™ P.O. Box 3141

Simi Valley CA 93093 - Add \$5.50 s/h continental U.S.

VISA/MC PHONE ORDERS Satisfaction Guar.

805 - 583 - 8173 Mon thru Fri 9A-5P (PT)

CIRCLE 251 ON READER SERVICE CARD

Subscribe  
To  
Radio Fun  
Call  
1-800-257-2346

TOLL  
FREE

1-800-666-0908

PRICING AND ORDERS ONLY

KENWOOD



Full KENWOOD line  
Radios & Accessories

YAESU



FT-411E  
&  
FT-415  
NEW!

Call for All YAESU  
Radios & Accessories

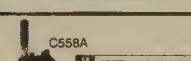
ICOM



Full ICOM line  
Radios & Accessories

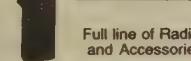
IC-229H  
IC-735

ALINCO



Full line of Radios  
and Accessories

C558A  
STANDARD



Full line of Radios  
and Accessories

AEA • ASTRON • COMET • CUSHCRAFT • DIAMOND • KANTRONICS • MFJ  
• SANGEAN • SONY SHORTWAVE • DRAKE • MANY MORE...

NEW EQUIPMENT PRICING AND ORDERS 1-800-666-0908 OUT OF STATE  
TECHNICAL, USED GEAR, INFO 203-666-6227 24HR FAX 203-667-3561

LENTINI COMMUNICATIONS INC.

21 GARFIELD STREET NEWINGTON, CT 06111

Hours: M-F 10-6, SAT. 10-4 C.O.D.s Same Day  
OK Shipping

CIRCLE 234 ON READER SERVICE CARD

Sell  
your  
Product  
in  
RADIO  
FUN

\*\*\*\*\*

Call  
Dan  
Harper  
TODAY!

1-  
800-  
274-  
7373



CREATE

CLP 5130-1  
LP YAGI BEAM  
50-1300 MHz  
CONTINUOUS COVERAGE

ELECTRONIC DISTRIBUTORS

325 MILL ST. NE VIENNA, VA 22180

PH 703-938-8105 FAX 703-938-6911

Place your order today with your favorite dealer!

ONE ANTENNA — ALL VHF AND UHF BANDS!



One antenna does it all!

The CLP 5130-1 covers 50, 146, 222, 440, 902, 1296MHz Ham bands, VHF, UHF, 800MHz Public Service bands, Military, Aircraft bands, even complete Television and FM broadcast band coverage!

- \* Outstanding performance with high forward gain, VSWR below 2.0:1 over entire frequency range!
- \* Compact and lightweight, all aluminum design, multi purpose horizontal or vertical mounting.
- \* Extra strong, commercial grade construction withstands the worst weather for unsurpassed reliability.
- \* Can pass as a conventional TV antenna! Perfect for apartment dwellers, those with limited space or antenna restrictions.
- \* Attention Future Hams: High performance, continuous coverage scanner reception now, all band transmitting beam ant. when you get your ticket!
- \* Also available: Create model CLP5130-2 LP Yagi Beam with continuous 105-1300MHz coverage in a smaller size.

If you could only have one antenna for complete VHF/UHF coverage, this would be it!

# Radio Fun flea market

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 30,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The Radio Fun Flea Market costs you peanuts (almost)—comes to 10 cents a word for individual (noncommercial) ads, and 70 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using.

Send your ads and payment to *Radio Fun Flea Market*, Judy Walker, 70 Route 202 N, Peterborough NH 03458, and get set for the phone calls.

The Deadline for the March 1993 Flea Market is January 20, 1993.

code music cassette today! \$9.95 ppd  
**KAWA Records**, P.O. Box 319-R,  
Weymouth MA 02188. RF247

**MINIATURE POLICE RADAR TRANSMITTER** one mile range, \$41 assembled, \$31 kit, (219) 489-1711. P.O. Box 80096, Fort Wayne IN 46898. RF251

**HOME BREW COMPONENTS.** Large SASE brings catalog. **KA7QJY COMPONENTS**, Box 3893, Logan UT 84323. RF271

**WEATHER INSTRUMENTS.** Digital and Traditional. Call for catalog. **THE WEATHER STATION**. 1-800-666-7014. RF280

**RADIO MODIFICATIONS** by FCC licensed electronics technician. \$39.95. SASE for radios covered and mods available. Scott Littfin, NOEDV, Route 1, Box 107A, Glidden WI 54527.

RF285

**FREE SHORTWAVE.** Convert any AM Radio to receive worldband shortwave signals for pennies. Instruction booklet, \$10. **ELECTROMAN**, Dept RF, Box 24474, New Orleans LA 70184. RF352

**INEXPENSIVE HAM EQUIPMENT.** Send stamp for list. **WA4DSO**, 3037 Audrey Drive, Gastonia NC 28054. RF559

**WANTED TO BUY:** 1991 Radio Amateur Callbook Supplement. **WA1ZKH**. (617) 464-3554. Bill Moynihan, 602 Dorchester Avenue, South Boston MA 02127. RF605

**RADIO SHACK HTX-100 10M** transceiver for sale. SSB/CW, 25W, microphone, manual and original packaging. Two years old, works great. \$150.00 ppd. **WP2AHE**, Joseph Despins, 919-233-6974 (evenings), 4705-0960. RF997

C Bluebird Court, Raleigh NC 27606. RF675

**TRADE IBM COMPATABLE SOFTWARE.** Ham, Electronics, all areas. Send your list with good description and I'll send mine. Scores of good programs. Donald Wahle N7URL, Box 1244, Jacksonville OR 97530. RF800

**VIDEOPHOTON /SATELLITE SCANNER/ CABLE/ AMATEUR/ CELLULAR.** Repair Manuals, Modification Books & Software. Catalog \$3.00. **TELECODE**, P.O. Box 6426-RF, Yuma AZ 85366-6426. RF963

**SECRET SCANNER** Frequencies: Federal, Police, Aero, Military, Cellular, Surveillance, also SWL & CB Books. Big FREE catalog! **CRB RESEARCH**, Box 56-RF, Commack NY 11725. RF996

**AWARDS AND CERTIFICATES FUN.** K1BV'S huge directory describes complete rules 2150+ different from 121 countries. \$19.40. Ted Melinosky, Box 960, Keene NH 03431-0960. RF997

## new products



### STARTEK INTERNATIONAL

The new model ATH-15 from Startek International is a frequency counter/frequency finder with an instant-reading RF signal-strength bar graph in a pocket-size aluminum cabinet. The fast response time and ATH™ (automatic trigger and hold) feature on this unit offer a distinctly new and improved feel to the operation of a portable frequency counter. The ATH-15 can read frequencies from 1 MHz to 1500 MHz, and the 10-segment 2"-long LED bar graph can give an instant RF signal-strength indication from signals below 1 MHz to over 4 GHz. There are two ranges with three selectable gate times on each range; maximum resolution is 10 Hz. The new ATH feature eliminates random counting and false readings. The response time from the beginning of the input signal to a stable accurate display has been dramatically reduced up.

The ATH-15 comes with factory-installed NiCd batteries. It is housed in a rugged, attractive black anodized aluminum cabinet measuring 3.5" x 4" x 1", and weighing about nine ounces. The ATH-15 is \$235, the CC-90 case is \$12 and the TA-90 antenna is \$12. For more information, contact *Startek International, Inc.*, 398 N.E. 38th St., Ft. Lauderdale FL 33334; (305) 561-2211, (800) 638-8050, Fax: (305) 561-9133. Or circle Reader Service No. 201.

### JAN CRYSTALS

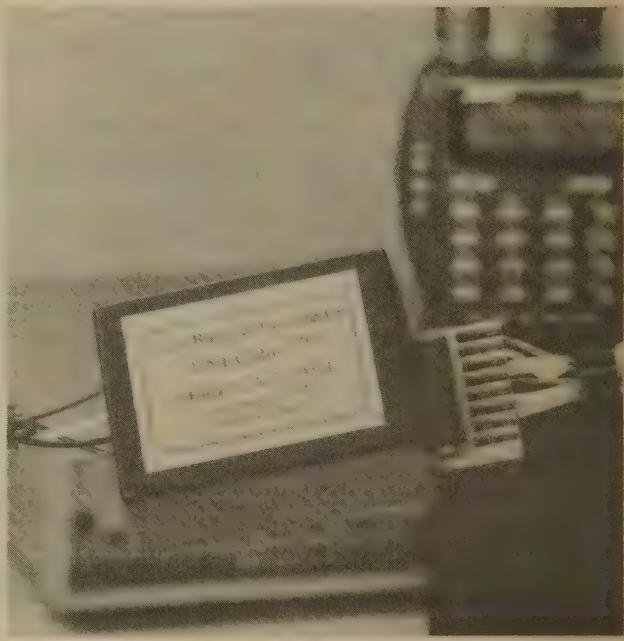
JAN Crystals has published a new catalog of quartz crystals and holders. This illustrated eight-page booklet contains descriptions, specifications and prices on crystals for frequency control, microprocessors, data transmission, tele-

metry and telecommunication voice. The catalog is free. Contact *JAN Crystals*, P.O. Box 06017, Ft. Myers FL 33906-6017; (813) 936-2397, (800) JAN-XTAL. Or circle Reader Service No. 202.

### OAK BAY TECHNOLOGIES

**OAK BAY TECHNOLOGIES** has announced a companion product to their UNI-Cable™ Universal Packet TNC/Transceiver cable line. The CA-232HH now provides the same universal solution for TNC-to-handheld cabling. The CA-232HH will virtually interface all popular TNCs to all popular handhelds that use the 2.5mm and 3.5mm microphone and earphone jacks. The CA-232HH was designed specifically for easy installation and configuration—its ability to be reconfigured to fit any of the popular TNCs and handhelds eliminates the need to purchase a different cable each time you change radios or TNCs. The installation requires no soldering.

The CA-232HH comes complete with the main interface unit, interface cables for the handheld, and easy-to-follow instructions. The list price is \$34.95 and the product is warrantied for one year. For more information, contact *Oak Bay Technologies, Inc.*, P.O. Box 65494, Port Ludlow WA 98365; (206) 437-0718. Or circle Reader Service No. 203.



### G & P ENGINEERING

**G & P Engineering** has announced a new style of antenna mounting system called the "N-PAM" unit. The N-PAM unit will mount on the roof without drilling holes into the roof. It will mount on any roof at any pitch from flat to a 12/12 pitch, and will allow use on roofs with 16" o.c., 24" o.c., stick-built or truss systems. Basic systems include single or dual tray units with a 2" mast 3' high—ideal for a tribander/VHF-UHF system. Options include a 5' or 7' mast. The 7' mast can be used with the largest OSCAR antenna system or stacked yagis.

All mounts are made of steel and are primed and painted with a durable and hard epoxy paint, black, to blend with most roof shingle colors. For prices and more information, contact *G & P Engineering*, 4943 Finch Court, Stephens City VA 22655; (703) 869-4530, Fax: (703) 869-5116. Or circle Reader Service No. 204.



# Uncle Wayne's Bookshelf

## BOOKS FOR BEGINNERS

02D42 Digital Novice by Jim Grubbs Geared to make you a more knowledgeable participant. \$8.50

01A87 Shortwave Listener's Antenna Handbook Primer antenna theory. \$13.95

05C25 Basic A.C. Circuits A step-by-step approach for the beginning student. \$24.50

05E50 Fun Way into Electronics Exciting build and learn projects. \$9.95

05E51 One Evenings Electronic Projects Easy inexpensive one evening projects. \$8.95

20N018 Technician Class License Manual: New No-Code by Gordon West This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. \$9.95

20N092 The Wonderful World of Ham Radio by Richard Skolnik, K4LCS Simple, clear, and fun. Introduces young people to amateur radio. \$7.95

20N100 Electronics Build and Learn (2nd Ed.) by RA Penfold Combines theory and practice so that you can "learn by doing." \$12.50

20N099 Digital Electronics Projects for Beginners by Owen Bishop Contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. \$12.50

AR2073 Novice Antenna Notebook A beginners guide to easy and effective antennas and tuners you can build. \$9.50

AR2871 W1FB's Help for New Hams by Doug DeMaw W1FB Complete for the newcomer. Put together a station and get on the air. \$10.00

AR2286 First Steps in Radio by Doug DeMaw W1FB Series of QST articles. \$5.00

## SHORTWAVE

06S57 1993 Passport to World Band Radio by International Broadcasting Services, Ltd You'll get the latest station and time grids. \$16.50

03S11 Shortwave Receivers Past and Present edited by Fred J. Osterman Guide to 200+ shortwave receivers manufactured in the last 20 years. The Blue Book of shortwave radio value. \$8.95

07R25 The RTTY Listener by Fred Osterman New and expanded. This specialized book compiles issues 1 through 25 of the RTTY Listener Newsletter. Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. \$19.95

03C09 Shortwave Clandestine Confidential by Gerry L. Dexter Covers all clandestine broadcasting, country-by-country: telis frequencies, other unpublished information: spy, insurgents, freedom fighters, rebel, anarchist radio, secret radio. \$8.50

03M21 US Military Communications (Part 1) US Military communication channels on shortwave. Covers frequencies, background on point-to-point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. \$12.95

03M22 US Military Communications (Part 2) Covers US Coastguard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. \$12.95

03M23 US Military Communications (Part 3) Completes the vast overall frequency list of US Military services, from 8983 KC to 27,944 KC. \$12.95

09S42 The Scanner Listener's Handbook by Edward Soomre N2BFF Get the most out of your scanner radio. \$14.95

03S208 Radioteletype Press Broadcasts by Michael Schaay Schedules of Press Services by time, frequency, and country broadcasting in English, French, German, Spanish, and Portuguese. \$12.95

11T88 Tune in on Telephone Calls by Tom Kneitel K2AES Formatted as a frequency list with detailed description of each service and its location in RF spectrum. \$12.95

03K205 Guide to Radioteletype (RTTY) Stations by J. Klingenfuss Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial, Meteo, PTTs, embassies, and more. \$12.95

11A510 Air Scan Guide to Aeronautical Communications (5th Ed.) by Tom Kneitel K2AES Most comprehensive guide to monitoring US aeronautical communications. Cover all Canadian land airports and seaplane bases, plus listings for Central America, the Caribbean, North Atlantic, and the Pacific Territories. \$14.95

15A002 Scanner and Shortwave Answer Book by Bob Grove Most frequently asked questions by hobbyists. \$13.95

07A66 Aeronautical Communications Handbook by Robert E. Evans Exhaustive, scholarly treatment of shortwave aeronautical listening. \$19.95

07R20 A Radio Journal 1912-1940 by Russ Rennaker W9CRC Easy to read and informative, educational and entertaining. A trip down memory lane to the early days of radio. \$7.95

11RF13 The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.) by Tom Kneitel K2AES This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. \$19.95

11F52 Ferrell's Confidential Frequency List, New Revised Edition compiled by A.G. Halligay All frequencies from 4 MHz-28MHz covering ship, embassy, aero, Volmet, Interpol, numbers, Air Force One/Two, more. \$19.50

11SR97 National Directory of Survival Radio Frequencies by Tom Kneitel K2AES Handy and concise reference guide to high interest communications frequencies required by survivalists. \$8.95

11SM11 Scanner Modification Handbook, Vol. 1 by Bill Creek provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. \$17.95

11EE06 Guide to Embassy Espionage Communications by Tom Kneitel K2AES Candid and probing examination of worldwide embassy and (alleged) espionage communications systems and networks. \$10.95

15D93 1993 Shortwave Directory (8th Ed.) by Bob Grove Extensively revised, the new 1993 Shortwave Directory is the consummate DXer's bible for the first 30 MHz of radio spectrum, including up-to-date and accurate. \$21.95

20N093 Vintage Radio 1887-1929 by Morgan E. McMahon The authoritative reference book for historians and collectors. \$8.95

07R26 World Wide Aeronautical Communications by Robert E. Evans Aircraft/Air Traffic Control, Aircraft/Company Operations, Aviation Weather Broadcasts, Aeronautical Flight Tests, Worldwide Military Air Forces, Aero Search & Rescue, Aero Law Enforcement, NASA Flight Support, Aero Terms & Abbreviations and Aero Tactical Identifiers. \$6.95

11T89 Scanner Modification Handbook Vol. 2 by Bill Creek Here it is—a companion to Vol. I. In fact, Vol. 2 has a section that provides improved approaches and updated techniques for the mods in Vol. 1. There's 18 new exciting modifications for popular scanners. \$17.95

03R01 World Press Services Frequencies (RTTY) New 5th Ed. A comprehensive manual covering radioteletype news monitoring—contains all information—antenna, receiving, terminal units, plus three extensive frequency lists. \$8.95

## SOFTWARE

04M54 GGTE Morse Tutor From beginner to Extra class in easy self-paced lessons. Code speeds from 1 to over 100 words per minute. Standard or Farnsworth mode. Adjustable tone frequency. Create your own drills, practice or actual exams. Exams conform to FCC requirements. 5 1/4" floppy for IBM PC, XT, AT, PS/2 or compatibles. \$19.50

04M55 Advanced Edition \$29.95 20N021 No Code Ham Radio Education Package Computer software package. Includes computer aided instruction software (IBM compatible), 200 page Ham Radio Handbook. \$29.95

20N022 Ham Operator Education Package Computer software contains five IBM compatible discs with all questions for all license classes, plus "Morse Academy" code teaching software that takes you from 0-20 wpm. \$29.95

Lanze Code Programs—(Available on 5 1/4" disk) Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, multiple choice answers, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

IBM Part# Commodore Part# Price  
Novice IBM01 COM01 \$14.95  
Tech IBM02 COM02 \$14.95  
General IBM03 COM03 \$14.95  
Advance IBM04 COM04 \$19.95  
Extra (New Pool) IBM05 COM05 \$19.95

IBM06, COM06 IBM/Commodore Tech No Code—Lanze Code Program Contains all the authorized FCC questions and answers used in testing formulas, schematic symbols, diagrams, and sample test for passing the new Technician No Code license. \$24.95

IBM97 Amateur Radio Part 97 Rules Includes updated, revised Commission's Rules, September 30, 1989 5 1/4" disk IBM compatible only. \$9.95

## STUDY AIDS

VIS Study Cards Compact, up-to-date Flash Cards with Key Words, Underlined, Quiz on back. Formulas worked out. Schematics at your fingertips. Used SUCCESSFULLY by ages 6 to 8!

NOVICE VIS01 \$11.95  
TECH VIS02 10.95  
GENERAL VIS03 9.95  
ADVANCED VIS04 15.95  
EXTRA VIS05 14.45

## UHF/VHF PACKET

01P22-2 The Packet Radio Handbook (2nd Ed.) by Jonathan L. Mayo KR3T "...the definitive guide to amateur packet operation."—Gwyn Reedy W1BEL Only \$15.00

09V11 The Basic Guide to VHF/UHF Ham Radio by Edward M. Noll Provides a first rate introduction to the 2.6 and 1.25 meter bands as well as 23, 33, and 70cm. \$6.50

20N019 U.S. Repeater Mapbook by William Smith N6MQS The Guide for traveling radio amateurs. \$9.95

03R02 RTTY Today by Dave Ingram K4TWW Most comprehensive RTTY guide ever published. \$8.50

## ANTENNAS

20N108 The Easy Wire Antenna Handbook by Dave Ingram K4TWW Gives you all of the needed dimensions for a full range of easy to build and erect "sky wires." \$9.50

01A70 Practical Antenna Handbook by Joseph J. Carr Design, build, modify, and install your own antennas. \$21.50

10A342 All About Verticle Antennas by William Orr Comprehensive coverage of amateur communications. \$10.50

10A345 Beam Antenna Handbook by William Orr and Stuart Cowan Everything you need to know about beam design, construction, and operation. \$11.95

05A59 Easy-up Antennas for Radio Listeners and Hams by Edward M. Noll Like to learn how to construct low-cost, easy-to-erect antennas? \$16.50

## ARRL BOOKS

AR1993 ARRL 1993 Handbook (69th Ed.) 39 chapters, featuring 2,100 tables, figures and charts. Comprehensive, well organized and affordable. \$25.00

AR1086-4 ARRL Operating Manual (4th Ed.) Information on how to make the best use of your station, including: interfacing home computers. OSCAR, VHF-UHF. \$17.00

AR194 Antenna Compendium Vol. 1 Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization. \$10.00

AR2545 Antenna Compendium Vol. 2 Covers verticals, yagis, quads, multiband and broadband systems, antenna selection. \$12.00

AR2626 Companion Software for Antenna Compendium Vol. 2 5 1/4" MS-DOS floppy. \$10.00

AR0488 W1FB's Antenna Notebook by Doug DeMaw W1FB Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. \$9.50

AR0348 QRP Notebook by Doug DeMaw W1FB Presents construction projects for the QRP operator. \$9.50

AR4141 W1FB's Design Notebook by Doug DeMaw W1FB Filled with simple practical projects that can be built using readily available components and common hand tools. \$10.00

AR2200 Antenna Impedance Matching by Wilfred N. Caron Most comprehensive book written on using Smith Charts in solving impedance matching problems. \$15.00

AR0402 Solid State Design Good basic information, circuit designs and applications: descriptions of receivers, transmitters, power supplies, and test equipment. \$12.00

AR0402 Solid State Design Good, basic information, circuit designs and applications: descriptions of receivers, transmitters, power supplies, and test equipment. \$12.00

AR3193 Weather Satellite Handbook (4th Ed.) by Dr. Ralph Taggart W8BDOT Expanded and revised to reflect today's weather-fax satellite technology. \$20.00

AR3290 Companion Software for Weather Satellite Handbook 5 1/4" MS-DOS Floppy. \$10.00

AR3291 Now You're Talking! Discover the World of Ham Radio. Covers everything you need to know to earn your first Amateur Radio license. More than a study guide, this book will help you select equipment for your ham radio station and explain how to set it up—everything you'll need to know to get on the air! \$19.00

AR3292 Your Introduction to Morse Code: Practice Cassettes Kit includes two 90 minute cassette tapes. Prepares you for the 5 WPM Morse code exam to earn your Novice license or add high-frequency worldwide communications privileges to your code-free Technician license. \$10.00

AR0437 ARRL Repeater Directory 1992-1993 19,000+ listings with digipeaters, bandplans, CTSS (PL/100) tone chart, frequency coordinators, ARRL special service clubs, and beacon listings from 14 MHz to 24GHz. \$6.00

AR1033 The DXCC Companion by Jim Kearman K7RS Spells out in simple, straightforward terms what you need to be a successful DXer. \$6.00

AR1250 Log Book—Spiral \$3.50

ARA341 Interference Handbook RFI sleuth's experience in solving interference problems. \$12.00

AR2197 ARRL Data Book Valuable aid to the RF design engineer, technician, radio amateur, and experimenter. \$12.00

AR2960 Transmission Line Transformers (2nd Ed.) by Dr. Jerry Sevick W2FMI Practical designs and specific information on construction techniques and sources of material. \$20.00

AR0410 Yagi Antenna Design A Ham Radio series polished and expanded by Dr. Lawson. \$15.00

AR2171 Hints and Kinks Ideas for setting up your gear for comfortable, efficient operation. \$8.00

AR3169 QRP Classics Compilation of ARRL publications on building receivers, transmitters, transceivers, accessories. \$12.00

ARRL License Manuals Complete FCC question pools with answers.

AR2375 Technician Class \$6.00  
AR2383 General Class \$6.00  
AR0166 Advanced Class \$6.00  
AR2391 Extra Class \$8.00

AR3185 The Satellite Experimenter's Handbook, (2nd Ed.) by Martin Davidoff K2UBC Expanded and revised. Focusing on satellites built by and for the international radio amateur community. \$20.00

AR0477 Low Band Dxing How to meet the challenges of the different forms of 160, 80, and 40 meter propagation with effective antennas, equipment, and operating strategies. \$10.00

AR2456 FCC Rule Book (8th Ed.) A must for every active radio amateur. \$9.00

AR2030 Your Gateway to Packet Radio (2nd Ed.) Tells everything you need to know about this popular new mode. \$12.00

AR2103 Satellite Anthology The latest information on OSCARS 9 through 13 as well as the RS satellites, the use of digital modes, tracking antennas, RUDAK, microcomputer, and more! \$5.00

AR2898 Space Almanac by Anthony R. Curtis K3KXK Recent news from space. \$20.00

AR2083 Complete DX'er (2nd Ed.) by Bob Locker W9KNI Learn how to hunt DX and obtain hard-to-get QSL cards. \$12.00

AR2065 ARRL Antenna Book The new 16th Edition represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. \$20.00

AR2329 Morse Code: The Essential Language by L. Peter Carron Jr. W3DKV Expanded and revised in its 2nd edition. How to handle distress calls heard not only on the hambands but on maritime and aircraft frequencies. \$6.00

## REFERENCE

202101 Everyday Electronics Data Book by Mike Tootley BA A basic electronic "recipe" book using commonly available components. \$18.00

20N102 Practical Digital Electronics Handbook by Mike Tootley BA Contains nine digital test gear projects. Digital circuits, logic gates, bistables and timers, microprocessors, memory and input/output devices. \$14.50

20N103 Electronic Power Supply Handbook by Ian R. Sinclair Covers many types of supplies—batteries, simple AC supplies, switch mode supplies and inverters. \$16.25

20N104 Electronic Test Equipment Handbook by Steve Money A guide to electronic test equipment for the engineer, technician, student and home enthusiast. \$18.00

20N105 Digital Logic Gates and Flip-Flops by Ian R. Sinclair A firm foundation in digital electronics. Treats the topics of gates and flip-flops thoroughly and from the beginning. \$18.00

01C80 Master Handbook of 1001 Practical Electronic Circuits Tried and proven solid state circuits. \$19.95

01P68 Pirate Radio Stations by Andrew Yody Tuning in to underground broadcasts. \$12.95

01T01 Transmitter Hunting by Joseph Moell and Thomas Curlee Radio direction finding simplified. \$19.95

02C30 Commodore Ham's Companion by Jim Grubbs Commodore computer and the Ham. \$9.50

03R02 Ratty Today by Dave Ingram Modern guide to amateur radioteletype. \$8.50

03S04 Hidden Signals on Satellite TV by Thomas Harrington The secret signals on the satellites. \$19.50

05E01 Basic Electricity and Electronics The fundamentals of electronics, book 1. \$11.95

05E02 Basic Electricity and Electronics The fundamentals of electronics, book 2. \$9.95

05E03 First Book of Modern Electronics Unique projects that are money saving. \$12.95

09D22 The World Ham Net Directory by Mike Witkowski New—2nd edition. Introduces the special interest ham radio networks and shows you when and where you can tune them in. \$9.50

09P33 Pirate Radio Directory by George Zeller Where to tune in on secret entertainment stations. \$7.95

10F093 1993 International Callbook The new 1993 International Callbook lists the calls, names, and address information for 500,000+ licensed radio amateurs in all countries of North America. \$29.95

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

02B10 Heath Nostalgia by Terry Perdue K8TP A brief history of the Heath Company of Benton Harbor, Michigan. \$9.50

10D093 1993 North American Callbook The 1993 North American Callbook lists the calls, names, and address information for 500,000+ licensed radio amateurs in all countries of North America. \$29.95

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

02B10 Heath Nostalgia by Terry Perdue K8TP A brief history of the Heath Company of Benton Harbor, Michigan. \$9.50

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

02B10 Heath Nostalgia by Terry Perdue K8TP A brief history of the Heath Company of Benton Harbor, Michigan. \$9.50

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

02B10 Heath Nostalgia by Terry Perdue K8TP A brief history of the Heath Company of Benton Harbor, Michigan. \$9.50

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

02B10 Heath Nostalgia by Terry Perdue K8TP A brief history of the Heath Company of Benton Harbor, Michigan. \$9.50

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

02B10 Heath Nostalgia by Terry Perdue K8TP A brief history of the Heath Company of Benton Harbor, Michigan. \$9.50

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAI 840 pages of everything you wanted to know about radio communication. \$29.50

## The Yaesu FT-102

by Avery L. Jenkins WB8JLG

Just as the day of the completely home-brewed station has passed, the era of the single-purpose rig has become history. Where once a ham might have had his CW rig for one band and a phone rig for another, today those functions have been integrated into one package. And as technology progresses, more and more functions can be squeezed in.

The Yaesu FT-102 is a perfect example of just how multi-model today's radios are. This new Yaesu has more modes and filters than Elmer had crystals, which makes it useful for the average ham—the one who sometimes contests (but doesn't necessarily win), sometimes DXes (but isn't on the DXCC Honor Roll), and who exclusively works neither CW nor phone.

Standard features on the Yaesu include an RF amplifier, speech processor, noise blanker, receiver and transmitter incremental tuning, peak and notch filtering, and IF passband controls.

Not bad, eh? Optional additions to the rig feature AM as well as 10 meter FM, SSB and CW filters, and an external VFO with push-button frequency input and 12 memories. And the matching speaker possesses two more audio filters for last-minute signal reception cleanup.

All of the WARC bands have been included on the transceiver, which belts 240 watts into the finals on SSB and CW below 25 MHz and 160 watts above. With the AM/FM option, the rig has a final input power of 80 watts on AM and 120 watts on FM. Frequency is, of course, PLL synthesized, and the audio quality of the transmitter may be tailored for the best intelligibility with your voice.

One of the most obvious features on the front panel of the FT-102 is the series of inset silver knobs just below the dual meters. These knobs operate the lesser-used controls such as the VOX, microphone gain, squelch, and speech compression. The knobs pop in and out so that once set, they are out of the way and will not be inadvertently readjusted. Just below the miniature controls are a series of switches which turn on the RF amplifier, noise blanker, and speech processor, and switch the crystal filters into the circuit. Standard AF/RF gain controls are provided, as are the AGC (fast and slow) and the receive preselector.

A surprising addition is the tone and clarity control, a feature too often overlooked by most other manufacturers. Nobody has ever claimed that ham radio is a hobby for audio-philes, but after four hours of 20 me-

ter cacophony or the crashing of 80 meters in the summer, my ears appreciate the small comfort a control like this offers.

### Receiving

When I first turned the transceiver on, I thought it was one of the worst-sounding receivers I had ever heard. 14.32 MHz sounded like a thunderstorm in the middle of a drag race, and only the strongest signals could be pulled in with any intelligibility.

That was before I caught the note in the manual which instructs you to turn the RF amplifier off in noisy band conditions. Chalk one up for reading the instructions first. With the amp off, signals became much clearer, but the receiver still possessed fine sensitivity. As I tuned around the band, one of the first things I noticed was the sharpness of the tuning—and this was before the filters were pressed into service. Unlike some other radios, the frequency readout is no more accurate than the selectivity of the front end—what you see is what you get.

As I gained more confidence in manipulating the basic controls, I began trying out the special features. The SSB crystal filter was easy to use and it enhanced selectivity. However, signals were more difficult to tune in because of the resulting sharpness. More difficult to learn were the IF shift and bandwidth controls. These controls, located on two friction-coupled knobs at the lower left of the front panel, allow you to select the best bandwidth for the band conditions. Width, of course, narrows the passband of the IF and it is possible to reduce the adjacent QRM without losing too much of your desired signal. Once the width has been set you can vary the center frequency of the IF to focus on the signal.

When using these controls, be ready to adjust your ears to the changing sound. Together, the two controls have enough range to render unintelligible a previously clear signal.

The peak and notch controls add another level of reception manipulation, this time in the audio portion. These filters are less powerful than the IF controls and are useful in the less strenuous conditions. Although I do not know if the engineers who designed the FT-102 intended the peak and notch filters to be used in this way, I found that they conditioned the sound to be more pleasing, if not necessarily less polluted.

Overall, I found the receiver quality to be one of the best I have encountered. The toughest part of using



The Yaesu FT-102.

the receiver is hanging on to a weak signal until you can get all of the controls peaked. While trying to eliminate adjacent QRM, it is easy to mask the signal you want because of the interactive characteristic of the controls. I learned this the hard way in a QSO with a Topeka station who mysteriously disappeared. I thought it was severe QSB working in hand with QRM until I realized that I had put the IF shift on the wrong side of the signal.

### Transmitting

From all reports, the FT-102 has excellent audio, due in part to the adjustments which can be made to tailor the transmitter to your voice. The first step is to cut in the monitor switch to hear your audio as others hear you. Two controls accessible through the bottom of the rig adjust high- and low-frequency attenuation. These are set-and-forget controls which need no adjustment unless you start using a different microphone or sell the rig.

The monitor function can also be used to help set the compression on the speech processor and avoid the negative effects of over-compression which void the gain derived from processing. It's no use getting an extra 5 dB if the person on the other end can't understand what you are saying. Short of having another ham tape your transmission and play it back, or using an oscilloscope, there is no better way to get your outgoing signal the way you want it. The monitor latches onto the audio in the transmitter IF so that you get a true indication of quality rather than just amplification of the microphone input.

Another useful transmitting feature is the ALC "peak hold" circuitry. The ALC meter will hold your voice peak for approximately one second to make

accurate adjustment of the mike gain control exceedingly easy.

Transmitter tune-up is a variation on the standard drive-plate-loading theme. Instead of varying the plate and loading controls simultaneously for a meter peak, the Yaesu manual recommends moving the load control up in discrete steps and adjusting the plate control until you reach a specified level on the meter.

CW fanatics will be glad to know that they can adjust the pitch of the CW sidetone to suit their taste. The FT-102 provides semi-break-in, with the VOX delay controlling T-R switching. Alternatively, the front panel MOX switch may be used, or an outboard switch may be connected to the rear-panel PTT jack. In addition, the instructions for the Yaesu include a section on how to squeeze as much juice as possible from the transmitter when operating on CW.

### Accessories

Most notable among the accessories for the FT-102 is the FV-102DM external VFO. Set in a matching cabinet, the VFO expands on the capabilities of the digital circuitry of the transceiver.

The FV-102DM's five-digit display displays kilohertz with a resolution to 10 Hz, and it may be tuned with the tuning knob or by using the built-in keyboard. Scanning speed may be adjusted, or you can enter a frequency directly on the readout to move instantaneously to another frequency. The keyboard also offers a stepping rate of plus or minus 20 kHz, or plus or minus 5 kHz, and both the keyboard and the tuning knob may be disabled when operating from the frequency memory bank.

Four tuning rates may also be se-

lected for the analog control, and any of these rates may be multiplied by a factor of 10 for super-fast tuning. A series of switches allows you to put the receiver and transmitter on your choice of VFOs, or place either under the control of the stored frequencies.

A second accessory, the speaker/filter combination, offers the final word in signal conditioning. The two filters used jointly can create a speaker response suited to any environment. You can attenuate highs or lows as well as choose your bandpass width. The speaker itself has been designed for communications responsiveness and even without the filters the sound is exceptionally sharp and clear.

Finally, the manuals which accompany both the FT-102 and the accessories have been well designed. They include clear and concise operating instructions in addition to tables which outline common control positions for a variety of situations. I am also happy to report that both have extensive theory-of-operation and service sections. Although the sections are certainly far from being comprehensive service manuals, they do cover most of the maintenance and troubleshooting procedures that the average ham would need to keep operating at peak capacity.

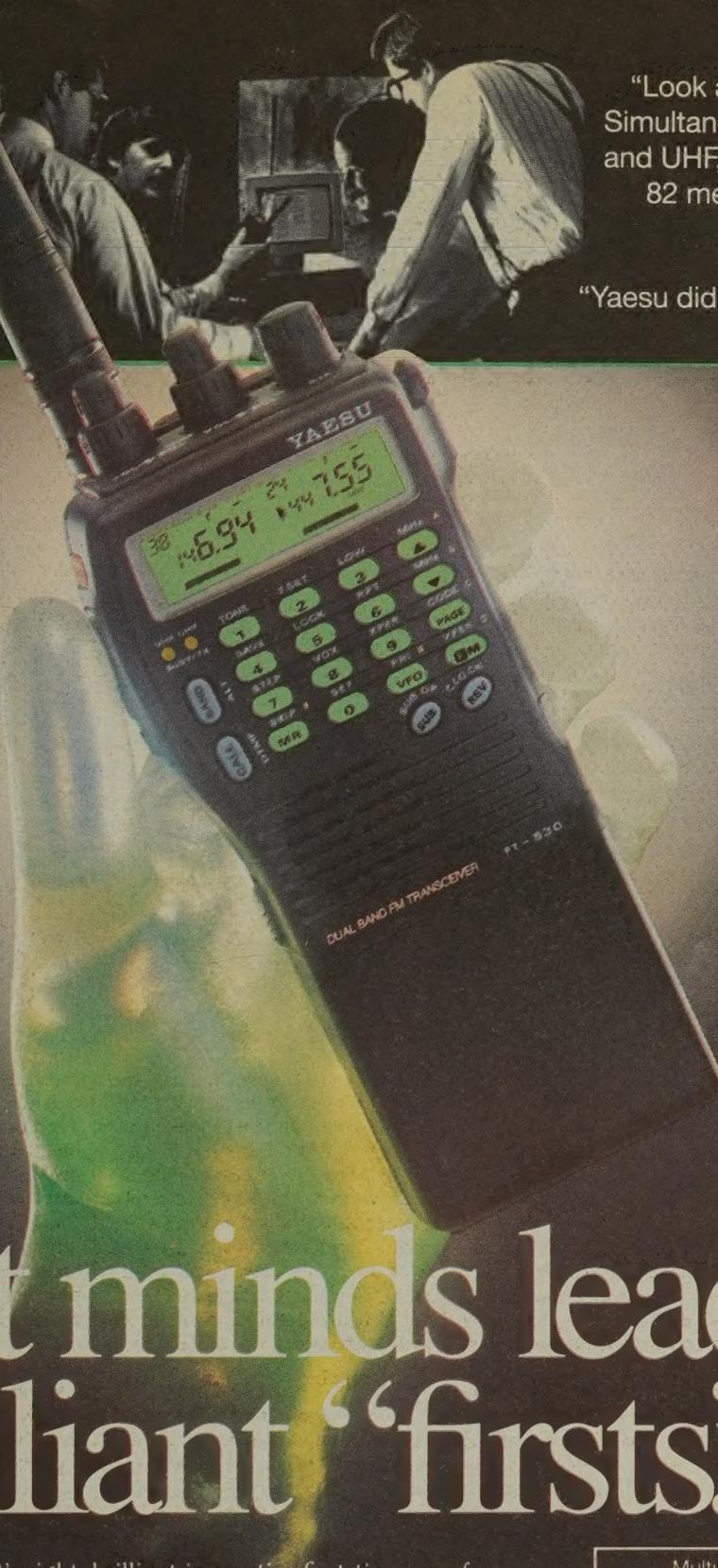
Although some would question the need for all of the options which the FT-102 and its accompanying peripherals present, I consider them welcome additions to the shack. Good operating requires access to a variety of techniques, whether you are running a phone patch or chasing DX, and this transceiver offers the necessary flexibility for successful hamming.

Reprinted from 73 Magazine May 1983.

## FT-530

### Dual Band Handheld

- Frequency Coverage:
  - 2-Meters 130-174 MHz RX
  - 140-150 MHz TX
  - 70 cm 430-450 MHz RX/TX
- 82 Memories (41 per band)
- 4 TX Power levels
  - w/FNB-25: 2.0, 1.5, 1.0, 0.5W
  - w/FNB-27: 5.0, 3.0, 1.5, 0.5W
- Dual in-band receive feature (V/V, U/U or V/U receive operation)
- DTMF Paging and Coded squelch included.
- AOT - Auto On-Timer with built-in clock
- ABS - Automatic Battery Saver (Super battery life, each band can have separate battery saver)
- Built-in VOX
- IBS - Intelligent Band Select (provides automatic TX band select on scan stop)
- Built-in CTCSS with dual decode
- ATS - Automatic Tone Search (displays incoming CTCSS frequency)
- Back-lit keypad and display with time delay
- Built-in cross-band repeat function
- APO - Automatic Power Off
- 5 Watts output w/ FNB-27 battery or 12 VDC
- 2 VFO's for each band
- Accessories:**
  - NC-42 1-hour Desk Charger
  - FNB-25 600 mAh Battery (2 watt)
  - FNB-26 1000 mAh Battery (2 watt)
  - FNB-27 600 mAh Battery (5 watt)
  - FBA-12 6 AA Cell Holder
  - CSC-56 Vinyl Case w/ FNB-25
  - CSC-58 Vinyl Case w/ FNB-26/27
  - E-DC-5 12 VDC Adaptor
  - YH-2 Headset for VOX
  - MH-12A2B Speaker Mic
  - MH-18A2B Lapel Speaker Mic
  - MH-19A2B Mini Earpiece Mic
  - MH-29A2B LCD Display Mic with Remote Functions
  - MMB-54 Mobile Mounting Hanger



"Look at this new FT-530! Simultaneous receive on VHF and UHF, automatic "on" timer, 82 memory channels..."

"Yaesu did it again!"

# Bright minds lead to brilliant "firsts."

That's right, brilliant innovative first-time ever features which make the FT-530 our most exciting HT addition.

Exclusive break-through features, too. Like flexible in-band dual receive. Not just V/U receive. With the FT-530 you can listen to two, 2-meter signals at the same time!

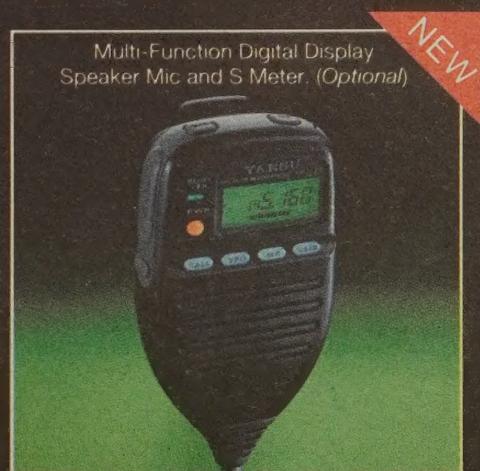
Another remarkable first is the Auto On-Timer™. Here's how it works. Choose the hour you'd like the radio to begin operating. For example, set the time for the morning, then wake up to your favorite net. What's more, the built-in 24-hour clock displays the time when the radio is off.

First out with 82 memory channels included, not an option; a real plus for storing all your favorite frequencies. With this HT, just open the box and QSO.

There's a lot of other terrific features too, such as built-in VOX and DTMF paging. And, since we know you'll find the FT-530 indispensable, we've included an automatic battery saver and voltage display - a powerful handful of exclusive features!

Be the first at your dealer's door to buy one, and the first to show off your new FT-530. What a bright idea!

Multi-Function Digital Display  
Speaker Mic and S Meter. (Optional)



# YAESU

Performance without compromise.™

# FIND FREQUENCIES FAST !!

## NEW AUTO TRIGGER & HOLD - 800% FASTER



**STARTEK** INTERNATIONAL INC  
ATH™ - BAR GRAPH FREQUENCY COUNTERS

Check out the **ALL NEW ATH-15** ... It's FAST !

The **ATH-15** can ACCURATELY READ an input signal, DISPLAY the frequency and AUTOMATICALLY switch to HOLD status, in less than 8% of a second !!

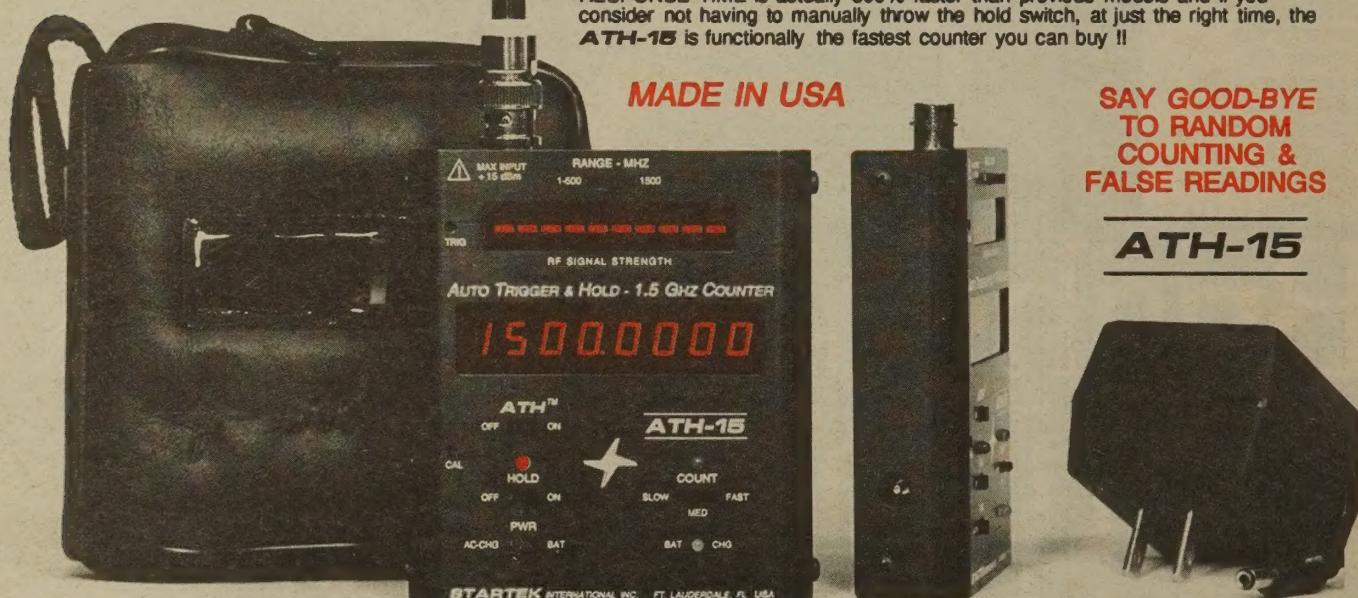
- **ATH™ - AUTO TRIGGER & HOLD**
- ONE-SHOT ATH™ OPTION
- AUTOMATIC CLEAN DROPOUT
- 800% FASTER RESPONSE TIME
- ULTRA BRIGHT LED DIGITS
- MAXIMIZED SENSITIVITY <1mV typ
- 3 to 5 HOUR NI-CADs STANDARD
- BATTERY CHARGE INDICATOR
- 4 GHZ - 2 INCH LED BAR GRAPH
- 2 RANGES - 6 FAST GATE TIMES
- 1 PPM TCXO STANDARD
- HIGH STAB 0.2PPM TCXO OPTION
- MANUAL HOLD FUNCTION
- BLANK DISPLAY FUNCTION
- 9-12V AUTO-POLARITY PWR JACK
- **StarCab™** ALUMINUM CABINET
- 1 YEAR LIMITED WARRANTY



**ATH™** refers to our exclusive new **AUTOMATIC TRIGGER & HOLD** circuit with **AUTOMATIC CLEAN DROPOUT**. With **ATH™** you can say good-bye to almost all of that annoying random counting and the false readings we have become accustomed to when using portable counters. The model **ATH-15** is an **ULTRA HIGH SENSITIVITY**, 1 MHz to 1500 MHz frequency counter with an **INTEGRATED BAR GRAPH** circuit which *Instantly* displays the signal strength of an input signal from <1 MHz to over 4 GHz. When the **ATH™** feature is used, the counter displays the last readable signal received. It automatically triggers on a readable signal and automatically switches to the "hold" status when the signal disappears. Because of **AUTO TRIGGERING**, the first reading is correct. If the signal stops in the middle of a sample or gate time, the last complete accurate reading will be displayed and the unit switched back to "HOLD" status, hence the **AUTOMATIC CLEAN DROPOUT** prevents the display of erroneous data, all this is done automatically, with hands free operation - and it works great !!!

We are further responding to user requests by offering a **ONE-SHOT ATH™** option. This consists of a **ONE-SHOT** select switch, a push button **RESET** switch and two LED indicators all located on the top of the counter (not shown). When this function is used, the first readable signal that triggers the counter will be held on the display until manually reset. One push of the reset button will reset the display to zeros and enable the one-shot circuit again. The display can be blanked or turned off pending the auto triggering from an input signal, which also saves power under battery operation.

**RESPONSE TIME**, defined as the time from the beginning of the input signal to a stable, accurate, readable display, has been dramatically speeded up. The **RESPONSE TIME** is actually 800% faster than previous models and if you consider not having to manually throw the hold switch, at just the right time, the **ATH-15** is functionally the fastest counter you can buy !!



SIZE: 4" H x 3.5" W x 1" D

**#ATH-15** FREQUENCY COUNTER  
WITH NI-CADS & 110VAC ADP \$235.  
FACTORY INSTALLED OPTIONS:  
#O/S-ATH-15 ONE-SHOT ATH™ 40.  
#HSTB-15 HIGH STAB TCXO 0.2ppm 100.

ACCESSORIES:

#CC-90	BLACK VINYL ZIPPER CASE	12.
#TA-90	TELESCOPING BNC ANTENNA	12.
#P-110	PROBE, 200 MHZ, 1X-10X	39.
#M207IC	CABLE FOR MFJ-207/208	10.

**STARTEK** INTERNATIONAL INC  
398 NE 38th St., Ft. Lauderdale, FL 33334

MADE IN USA

SAY GOOD-BYE  
TO RANDOM  
COUNTING &  
FALSE READINGS

**ATH-15**

CHECK IT OUT... BEFORE YOU BUY A COUNTER  
Does Bar Graph give **INSTANT** readings or 3 gate times delayed?  
Does Bar Graph work on every range? Over 2 GHz? With HOLD on?  
Does HOLD switch **CHANGE** THE GATE selection when turned off?  
Does unit **SELF-OSCILLATE** - random count with no input signal?  
How many switches needed to select range? Gate times per range?  
How long does unit operate with batteries? One hour?  
NO PROBLEM with a **STARTEK POCKET COUNTER** !!

ALL MODELS  
IN STOCK  
WE SHIP  
SAME DAY !

Orders & Information

**305-561-2211**

Orders only

**800-638-8050**

FAX 305-561-9133



TERMS: Shipping-handling charges for Florida add \$4 + tax,  
US & Canada add 5% (\$4 min - \$10 max), others add 15% of  
total. COD fee \$4. VISA, MC or DISCOVER accepted. Prices  
& specifications subject to change without notice or obligation.

**STARTEK** - FIRST WITH FEATURES YOU CAN USE AND  
FUNCTIONS THAT WORK PROPERLY. WHY SETTLE FOR LESS?

CIRCLE 247 ON READER SERVICE CARD